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Cost, Distribution and Utilization of Farm Machinery in Iowa

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CONTENTS

SUMMARY

1. Small farms have fewer tractors and tractor-drawn machines per 100 farms than larger farms. Among types of farming areas, the Southern Pasture area has the fewest and the Cash Grain area the greatest number of tractors or tractor-drawn machines per 100 farms.

2. Small farms have more machinery available per 1,000 acres of farm land than do large farms. On a type of farming basis, the Southern Pasture area has the greatest amount of horse-drawn machinery and the smallest amount of tractor-drawn equipment per 1,000 acres of farm land. The reverse is true for the Cash Grain area.

3. Horse-drawn machines have a higher average age and have been used a greater percentage of their estimated life than tractor-drawn machines. The same relationships hold true in comparisons between large and small capacity machines.

4. The number of unused horse-drawn implements per 100 farms is greatest in those areas where adoption of tractors has been most recent.

5. Annual service of machines tends to vary with farm size except for custom-operated machines. Machines such as the combine and cornpicker may often see more service in the hands of the small farm operator. This is because small farmers are more likely to do custom work or to loan or hire out machines than are the large farmers.

6. Comparison of the annual service of all machines with that for the most used machines indicates that the excess capacity on Iowa farms is quite considerable. However, timeliness of operations tends to limit the duty of farm machines. Some excess capacity is desirable in order to cope with wet and backward seasons.

7. Pooling higher capacity machines makes possible a re-

duction in man-days and tractor-hours required in performing farm operations. Pooling equipment should not be extended to the point where it might interfere with timeliness of operations.

8. Such machines as the combine, cornpicker and ensilage cutter—with a high initial cost, high capacity relative to annual use on individual farms and special power requirements —are most often owned in partnership. These machines are used on a greater number of farms and are used on a custom or hired basis more often than are other machines.

9. Depreciation and interest make up the most important part of machine costs. Depreciation costs averaged 4.8 percent of the first cost of all machines and ranged from 3.2 percent for the wagon to 9.0 percent for the 5-foot combine. Total annual cost averaged 10.9 percent of the first cost for all machines and ranged from 8.0 percent for the 7-foot grain drill to 20.8 percent for the hammer mill feed grinder of 80 bushel per hour capacity.

10. Although there is some variation in total annual cost of machines by farm size, this cost does not differ greatly from the average of all machines in any case. However, large farms have a much lower machine cost per unit of service than do small farms. In many cases the cost per unit of service on small farms is greater than would be the custom charge for performing the operation.

11. The desire to be independent often causes a farmer to own a machine singly at a higher cost per unit of service than would exist under cooperative ownership. Other reasons for high machine costs are insecurity of tenure, ignorance relative to machine costs and resistances growing out of inability to arrive at satisfactory rental charges.

Cost, Distribution and Utilization of Farm Machinery in Iowa[1]

By Earl O. Heady, J. A. Hopkins and E. G. McKibben.

The entry of the United States into World War II augmented the necessity of utilizing agriculture's resources to the fullest extent in meeting increased food demands with reduced supplies of labor. One of the principal means of expanding production under such conditions is by fuller use of available farm machinery. Unfortunately, however, when a state of national emergency was declared in May, 1941, little was known either about the utilization of Iowa farm machinery or about the numbers of various types of machines available on the farms.

To provide the needed information a survey was conducted in August and September of 1941 with the cooperation of the Work Projects Administration and the Agricultural Marketing Service. Information was collected in August from 2,911 farms regarding corn planters, grain binders, grain drills, double disks, single disks, hay loaders, manure spreaders, mowers, plows, rakes, rollers, seeders, spike harrows and spring tooth harrows. The September survey obtained information from 3,012 farms on cornpickers, combines, ensilage cutters, grain elevators, corn shellers, feed grinders, milking machines, tractors, trucks, trailers and wagons[2] (table 1).

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[1]Project 729 of the Iowa Agricultural Experiment Station, Project O.P. 165-2-285, Work Project 5782 of the Work Projects Administration and Project 6040, Iowa Farm Data Survey, Agricultural Marketing Service.

[2] The data were obtained from 988 sampling blocks covering the entire state and selected at random in each county. Each sampling block comprised a section of land. The number of blocks in each county was proportional to the total land area of the county. As far as was possible schedules were taken from all the operating units which had farmsteads within the section, but excluding areas within or adjacent to incorporated towns. A few schedules were also taken outside the sampling blocks. The average farm size in the September survey was 179.4 acres as compared to 163.8 acres for the state in 1940. Table 1 indicates the distribution of farms by size and type of farming area in the September survey. The August survey included a similar distribution of size and type. As a check on the reliability of the data, the acreage of corn for the state was calculated on the basis of the reported use of corn planters, and this acreage compared with that reported by the Crop and Livestock Marketing Service. The difference between the figures was less than 2 percent.

DISTRIBUTION OF IOWA FARM IMPLEMENTS

NUMBER OF MACHINES REPORTED

A total of 38,083 individual machines was reported in the two surveys. Information was gathered on 25 common farm implements. Others exist on Iowa farms but are less important. Table 2 indicates the number of machines by size and by type of power used.

For the state, 75.8 tractors were reported per 100 farms (table 3). However, this number varies from 22.6 tractors per 100 farms on farms smaller than 41 acres to 115.9 for farms over 360 acres. It was noted also that the smaller farms were more likely to have the older type of four-wheel tractors rather than the newer and more convenient row-crop type. Further, the number of tractors per 100 farms varied by type of farming areas from 45 in the Southern Pasture area to 94 in the Cash Grain area. Elsewhere the number ran from 73 to 86 per 100 farms.

The combine is another machine of importance in relieving the labor load in a critical season. Six of these machines were reported per 100 farms, but with the numbers varying, again, with the size of farm and the farming area. The Southern Pasture area reported only 3.9 combines per 100 farms as compared to 8.2 in the Eastern Livestock area. The 5-foot combine was the most common size found in all areas except in the Cash Grain area, where the level land and larger crop acreages have favored the 6-foot machine.

The mechanical cornpicker is another highly important labor-saving machine. It was reported by 17.5 farmers out of 100 for the state. But the Southern Pasture area had only 3.9 as compared to 30.0 per 100 farms for the Cash Grain area. The size of machine also varied between areas, with the Southern Pasture and Northeast Dairy areas reporting more one-row than two-row cornpickers. The opposite was true for the rest of the state.

In general, larger farms reported the greater number of tractors and tractor-drawn equipment as well as larger machines. This is explained mainly by larger crop acreages and by less labor relative to scale of operations on the large farms. There is a similar difference between areas with the greatest amount of tractor-drawn equipment in the Cash Grain area and the least amount of tractor-drawn equipment in the Southern Pasture area. The variation is best explained here by differences in crop acreages and in topography.

The number of machines per 100 farms; however, does not

reflect the over-all availability of farm machinery relative to crop area. For example, suppose one machine was reported on each 250-acre farm as compared to only one on each four farms in the 40-acre size group. This would indicate that the smaller farms are less well-equipped. On an over-all basis, however, the small-sized farms as a group would have 6.3 machines per 1,000 acres of land as compared to only 4 for the large sized group. Figures giving the percentage of farms with machines or the number of machines per 100 farms can

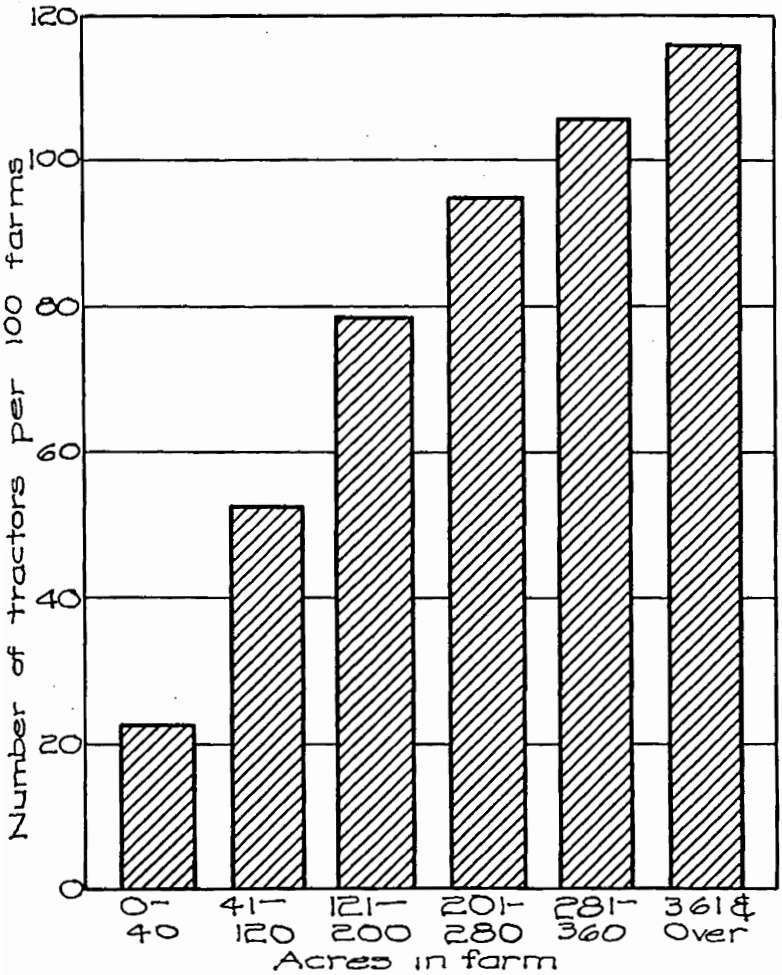

Fig. 1. Number of tractors per 100 farms, by size of farm.

best be used to show the equipment complement where cooperative use does not take place. Expression in terms of machines per unit of area best shows the picture when availability of machinery is increased through cooperative use.

DENSITY OF FARM MACHINERY

The term density as here used expresses the working width of available machinery per 1,000 acres of land. This is by no means a perfect measure but is used in lieu of a better one (table 5). It represents approximately the machine availability in case of extensive cooperative use.

Although small farms may have fewer machines per 100 farms, as a group they have more equipment per area of land and per unit of output than do larger farms. This is notably true in the case of horse-drawn equipment and to a lesser extent in the case of tractor-drawn equipment. The excess capacity of machinery on the small farm group, however, is not as great as the variation in this index, since a greater proportion are horse-drawn implements with a lower capacity per unit of width. The distribution of machines as mentioned above does not hold true for combines, cornpickers, corn shellers and other machines which have a high initial cost and which are used only a few days on each farm annually or may be obtained by custom arrangements.

Table 5 shows that farms 40 acres and less in size have nearly four times as many tractors per 1,000 acres of farm land as those over 360 acres and nearly twice as many as the average of all farms. This comparison is in numbers only and does not allow for differences in size of tractors. Differences in available power per acre are probably less because of the tendency for smaller tractors to be used on small farms.

Although table 5 shows the rather high over-all availability of tractors and tractor-drawn equipment on smaller farms as compared to other size groups, it says nothing about the situation on individual small farms. Table 3, showing the number of machines per 100 farms, indicates that small farms generally have fewer machines available than do larger farms. Insofar as the machines can be used cooperatively, the small farms are best equipped as a group. To the extent that cooperative use is not or cannot be exercised, farms in this size group lack the degree of mechanization found on larger farms. On the other hand, those individual small farms which do own tractor-drawn equipment possess a much greater unused capacity than larger farms with the same equipment.

When we compare type of farming areas we find that the density of horse-drawn equipment is greatest and tractor-drawn is lowest in the Southern Pasture area. Conversely, the density of horse-drawn equipment is lowest and of tractor-drawn equipment is greatest in the Cash Grain area.

A better measure of density and availability of farm machinery would be expressed in terms of machine width per area of crop land or per area of specific crops. This information was not included in the survey but table 6, derived from 1940 census data, shows the percentage of land harvested as crops in 1940. It indicates that the relative density of the groups, if measured by crop acres, would be somewhat changed, but that the same general relationships between size of farm or type of farming area would still exist. Density in terms of crop acres would be greater for small farms relative to the average than is indicated in table 5; for medium sized farms it would be less, and for large farms a little greater than when expressed in terms of all land.

Since on an individual farm basis the Southern Pasture area has less tractor equipment per 100 farms than other areas, any extension of cooperative use may effectively lessen the differences in machine availability in such areas, as is suggested by the density figures of table 5.

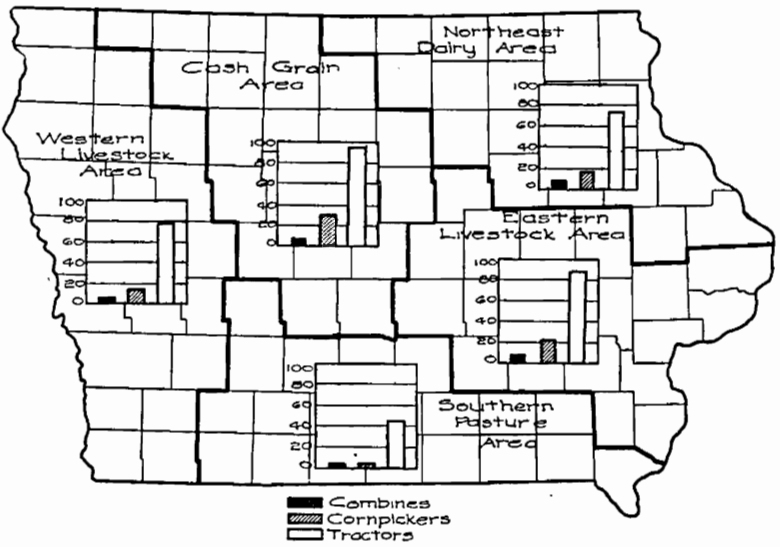

Fig. 2. Number of combines, corn pickers and tractors per 100 farms, by type of farming area.

AGE DISTRIBUTION AND LIFE OF IMPLEMENTS

Present age and estimated total life of machines varied greatly between individual farms. There was a slight tendency for present age of the most common machines to be a little greater on small farms than on larger farms. This may be explained by the fact that the annual service is less and that the machines are more frequently purchased second-hand by small farm operators.

Estimated total life of the various machines likewise tended to be a little greater on the smaller farms, although the differences do not appear very significant. A comparison by type of farming areas did not indicate any noticeable difference in estimated total life of machines. Probably much more important than either annual use or topography as factors in the total life of machines in Iowa is the care given to the individual machine and the timeliness of repairs and lubrication. This was evidenced in the great variation in estimated total life of machines within size groups or type of farming areas.

Estimated total life of machines was obtained by adding the farmer's estimate of remaining life to the present age. This method may tend to hide some of the correlation between machine life and annual use. Estimates tend to be given in multiples of 5, hence a farmer using a machine a great deal annually may think his machine will last 8 years but will round out the estimate to 10 years. Another operator might think his machine of the same age will last 11 years but round the estimate to 10 and thus the difference is obscured. However, this method gives a general indication of average total life to be expected and is the only alternative to collecting information on machines that are completely worn out. The last mentioned method would involve prohibitive costs in time and expense required for an adequate sample. Furthermore, very few machines are actually worn out before being traded in for new ones.

It is also possible that the large scale operator who makes greatest annual use of a machine may also be the one who gives it the greatest care. Accurate determination of the effect of use on life would thus require classification of machines by degree of care exercised by the owner as well as by annual service.

Table 9 presents the average age and estimated total age of machines included in the study. In general those machines with the most moving and breakable parts have the shortest life. However, exceptions can be noted in that the life of

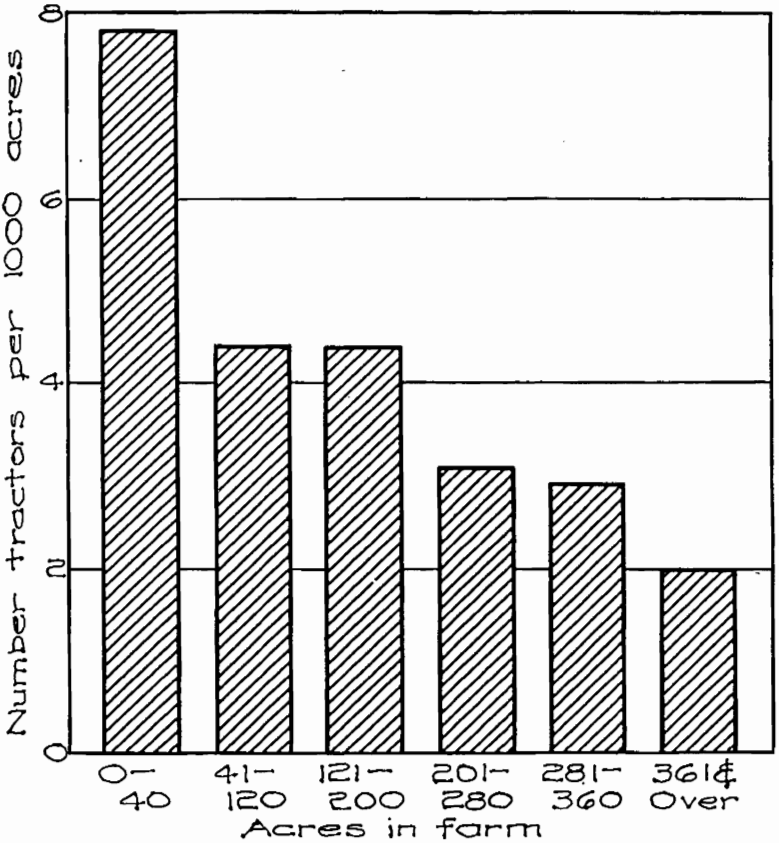

Fig. 3. Number of tractors per 1,000 acres, by farm size.

grain binders and corn shellers is usually much greater than that indicated for combines and tractors regardless of the relatively large number of moving parts in the former. There may, however, be some tendency to underestimate the remaining life of machines when they are relatively new, as is the present case with most Iowa combines.

The estimated total life for combines is less than that for any other group of machines and averages 9.9 years.[3] Estimated life for other machines varies upward to 27.5 years for the wagon.

On the average, in 1941 combines had been used less than

[3] This low estimated life for combines is no doubt due in part to the low present age of combines in Iowa. Farmers tend to underestimate the life of new machines.

30 percent of their estimated life. Four-wheel tractors had been used 59 percent of their estimated total life as compared to 38 for the row-crop tractor. Of greatest relative age were the 7-foot horse-drawn binders which, on an average, had been used 75 percent of their total estimated life. At the other extreme, the four-row tractor-drawn cultivators had been used only 18 percent of their total life. Since mechanization has been rapid in recent years, tractor-drawn equipment is relatively newer than that drawn by horses. Larger capacity machines also have relatively more years of remaining life. The shift in types of machines is still continuing; hence this difference in relative age will be maintained for some time in the future.

The shift to tractor power has meant that a decreasing number of horse-drawn implements are purchased each year. This trend became pronounced from 1930 to 1932, as is indicated in the distribution of table 10. Purchases of many horse-drawn machines have been negligible or have ceased entirely in the past few years. The rate of adoption of tractors and complementary equipment, along with the economic conditions that affect such purchases, resulted in the greatest number of such machines falling in the 4-to-6-year age group in 1941. Although combines and some of the other larger machines continued to be added at about the same rate in 1941, increased farm incomes in that year, plus the beginning of a farm labor scarcity, account for purchase of a rather high proportion of tractors and tractor equipment.

UNUSED HORSE-DRAWN EQUIPMENT

The number of horse-drawn machines released from use by adoption of tractor implements has been greater than replacement needs on those farms retaining horse power. It has sometimes been suggested that this equipment is idle on farms in the highly mechanized areas whereas it is needed in those areas still utilizing horse-drawn equipment. The data reported in this study indicate that it is the latter areas of Iowa which still posses the greatest concentration of unused equipment. The Cash Grain area shifted to tractors and tractor-drawn equipment earlier, and to a greater extent. Evidently the excess of horse-drawn equipment here has already been disposed of because this area reported the smallest number of unused machines per 100 farms. Conversely, in the Southern Pasture area where the shift to tractors was slower and more recent, more unused equipment was reported. Figures in table 11 include only machines reported on the farms in the survey and do not account for those that might be held by dealers.

UTILIZATION OF FARM MACHINES

ANNUAL SERVICE OF FARM MACHINES

How wide a variation is there in the annual amount of use made of farm implements? And to what extent might the degree of utilization be increased without causing a serious loss in other directions?

The average number of acres covered by field machines ranged from 20.6 for horse-drawn plows 18 inches or less in working width to 367.8 acres for the four-row, tractor-drawn cultivator. The 5-foot combine was used on an average of 64.9 acres on the home farm plus 101.4 acres on other farms. The two-row cornpicker was used on an average of 99.5 acres on the home farm plus 63.4 on other farms.

The annual service of machines on farms 281 acres and over was approximately twice as great as for those on farms less than 121 acres and one-third greater than for the average for all farms. On farms of 120 acres and less the accomplishment for machines of the same size and type was only about 50 percent of the average for farms of 121 acres and larger. Table 12 indicates total annual service for all machines and table 13 indicates use on the home farm.

Although the annual use of the most common farm machines varies with farms grouped by size, there are exceptions on some individual small farms where the scale of the enterprise is large relative to the number of acres in the farm. However, there is still a significant difference between the size groups, as was indicated by analysis of variance tests except for machines such as the combine and cornpicker, which are used on many farms under custom arrangement. These machines, which are required for only a few days per farm annually and which are used on a custom basis, may see greater service when in the hands of the small scale operator. In order to supplement his income and utilize his labor to a greater extent, the owner of a small farm may perform custom work for his neighbors and thus cover a greater number of acres than a large scale operator who allocates part of his time to other enterprises.

More of the machines on small farms are used on other farms, and a greater proportion of the annual service is performed on others than is the case of those on large farms. With the exception of a few machines where the high initial cost, high capacity and special power requirements have favored or forced custom operation, the total annual service is still greater on the large farms. In the case of the tractor-drawn, two-row corn planter, 30 percent of the annual service of

machines owned on farms of 120 acres or less was performed on other farms as compared to only 3 percent for those on farms of 281 acres and over. Still, the number of acres covered by corn planters on the larger farms was 2.4 times that of machines on the smaller farms. However, in the case of the 7-foot combine, the total annual service as well as percentage of annual service covered on other farms was greater for the machines on the farms of 120 acres or less.

UTILIZATION OF MACHINE CAPACITY

Analysis of variance tests indicated significant differences in annual use of all machines between different farm size groups except for those commonly operated on a custom basis, such as combines and cornpickers. Differences between machines used on the owner's farm only and those used in addition on neighbors' farms were significant for custom operated machines as well as for others.

Combines with a 6-foot cut which were used on other farms covered 302 percent more acres than those used only on the home farm, while the most used machines covered an average of 166 percent more than for that for all machines (table 16). The two-row cornpickers used on other farms covered 54.9 percent more than those used on the home farm only, while the most used machines covered 65.9 percent more than for all machines. For the two-row, tractor-drawn cultivator the comparative figures are 29.9 and 71.9 percent, for the tractor plow 34.4 and 74.3 percent, and for the two-row, tractor-drawn corn planter, 49.2 and 57.9 percent.

Comparison of average use of all machines with that for those included in the largest farm size group, those used on other farms, or the most used machines emphasizes the existence of unused capacity of Iowa farm machinery. Comparisons with the most used machines probably over-emphasize potential capacity, since these machines may have been operating under optimum conditions. Some unused capacity is desirable from the standpoint of an operator who thinks in terms of annual returns or of a nation attempting to meet maximum production goals. In case a wet and backward season is encountered, the loss from lack of equipment may be greater than the saving of resources that would result from cutting the equipment supply to meet only optimum weather needs. Some excess capacity is justified by increasing the certainty of timely performance of field operations.

Cooperative use of implements is an effective method of utilizing capacity as well as lowering equipment expense. In

the case of most planting and tillage machines in Iowa, there is considerable room for extending cooperative use without seriously impeding production. Such practices can only be carried up to the point where they might interfere with timeliness of operations.

SUBSTITUTION OF LARGER CAPACITY EQUIPMENT

During the last few years there has been a pronounced trend toward the use of larger machines. This is particularly evident in data on farm machinery manufacture and sales. It is also apparent in the lower present age of the greater-capacity machines shown in table 9. Advantages of larger-capacity machines may be technological or economic or both. The principal advantages are decreased labor requirements per unit of output and increased timeliness in the performance of critical farm operations. The latter is especially important for seeding and harvesting operations. The degree to which machine capacity can be substituted for labor depends on the relative costs of machinery use as compared to wage rates and on the availability and effectiveness of labor. During periods of acute labor shortages and high labor costs, the farm operator may profitably increase capacity of equipment; or, conversely, low cost labor may be economically utilized in the place of greater working width of the machine.

Although economic limitations to increased size are generally recognized, the fact that there are also mechanical limitations is often overlooked. Each unit of working width added to a machine results in a smaller saving of labor and a smaller increase in timeliness than did the preceding increment. This is exemplified in the assumed figures of table 17, which show that adding the second row to a machine saves 0.50 hour per acre, the third row 0.17 hour, the fourth row 0.08 and the fifth row only 0.05 hour. The same relationships apply to the increase in timeliness. Thus, even if equal effectiveness per row of operating width is assumed, the benefit from adding the fifth row is only one-tenth as great as that from the second row.

Even table 17 tends to under-emphasize decreased savings in labor and timeliness with increased size of machine. Equal effectiveness per unit of width for wider machines should not be expected. A larger machine will usually be operating a smaller percentage of the time since it takes longer to service, lubricate, adjust and supply with material. In addition, whenever it is necessary to stop the machine to make repairs or adjustments, a larger amount of machine capacity is kept idle if the machine is a large one than if it is small. Thus, if

a two-row cornpicker is being used and one unit breaks down or clogs, both rows are stopped while adjustments are being made.

Although the increase in work accomplished per day may be less than proportional to added machine size, the increase in service per season may be more than proportional to added machine size. A two-row cornpicker would be expected to cover less than twice the acreage covered per day by a one-row picker. However, as can be figured from table 12, the two-row machine covered 2.4 times as many acres per season as the one-row. The tractor-drawn, four-row cultivator covered 2.4 times as many acres per season as the two-row. The 6-foot combine, which would be expected to harvest not in excess of 20 percent more acres per day than the 5-foot, covered 21.3 percent more acres per year. The theoretical difference between 5- and 6-foot mowers would be no greater than 20 percent, whereas the actual difference was 35.5.

In some cases actual difference in annual service was less than proportional to added width, but larger machines were generally more effective per unit of size.

Tractor-operated machines covered substantially more acreage during the season than did horse-drawn machines of the same size. Illustrative of this is the fact that tractor-drawn, two-row cultivators covered 90 percent more acres than horse-drawn machines. Comparative figures for the 9- to 10-foot disk, two-row corn planter and one-bottom plow are 41, 62 and 177 respectively.

COOPERATIVE OWNERSHIP OF FARM MACHINERY

The more expensive farm machines, excluding tractors, are often owned in partnership. Machines best adapted to this form of ownership are those which are used only a few days per year on each farm. Table 19 indicates the extent of cooperative ownership found in the study. Machines most frequently owned in partnership were: Stationary ensilage cutter, 45 percent; field ensilage cutter, 35 percent; combine, 23 percent; cornpicker, 22 percent; tractor-drawn roller, 20 percent; shellers, 16 percent; and horse-drawn roller, 14 percent. Only 1 percent of wagons and horse-drawn plows were so owned.

Field machines are more frequently owned cooperatively by small farm operators than by those with greater crop acreages. This is an effective method of lowering the machine cost per unit of output, especially where the original cost of the machine is great and the annual days of service are few.

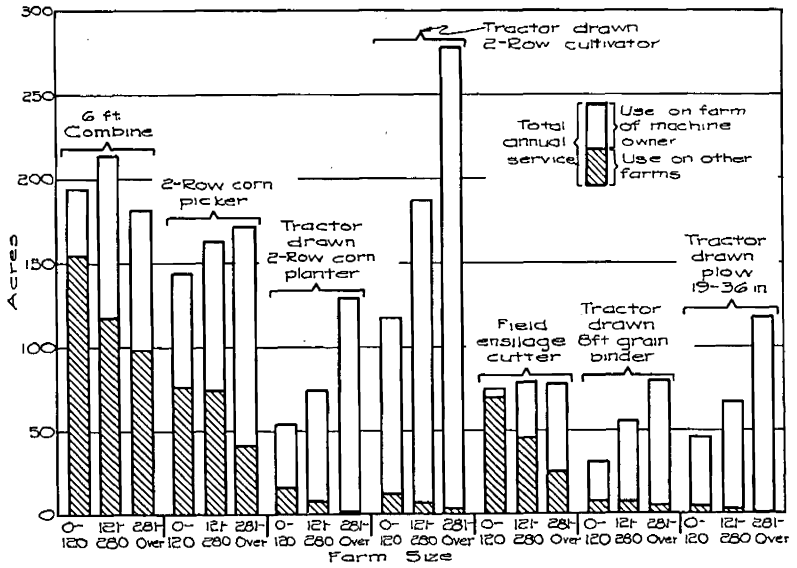

Fig. 4. Annual service of specified machine on owners' and other farms.

Economic ownership is thus often made possible for the farmer who would otherwise have to hire or borrow the machine. Uncertainty of tenure, the desire to be independent of other farmers, possible friction as to who will use the machine first, and laxness in care of the machine often discourage cooperative ownership.

The limit of economies from cooperative ownership and use is again established by timeliness of operations as far as the individual operator interested in maximum returns is concerned. For example, if cooperative use of cornpickers were extended to a point where one participating cooperator lost a bushel of corn per acre valued at 70c, the loss capitalized at 5 percent would be as great as an additional annual machinery cost of $14 per acre.

USE OF MACHINES ON FARMS OTHER THAN THE OWNER'S

Machines most frequently used on farms other than that of the owner include those which have a high initial cost and those which are used only for a few days on each farm annually. Table 19 also includes that use of machines on other farms and terms of use. Those most frequently used on other farms were: Combines, 73 percent; field ensilage cutter, 53 percent; stationary ensilage cutter, 45 percent; and corn-

pickers, 55 percent. The smaller the farm the greater is the tendency to use the machine on other farms. However, the annual use of most machines owned by large operators is still greatest, as is evidenced in table 12.

The kind of machine most often owned in partnership and used on farms other than those of the owners is also the one for which some payment is most frequently made. Illustrative of this is the fact that 70 percent of the combines, 46 percent of the cornpickers and 60 percent of the corn shellers were used on a custom or hired basis. Machines most frequently loaned to others with no payment are the more common machines with fewer breakable parts and relatively longer lives, such as the corn planter, cultivator, disk, grain drill, mower, plow, rake, roller and seeder. Horse-drawn equipment is more often used on a loan basis than is tractor-drawn equipment. For one thing, the latter is often designed to be used only with specific makes and sizes of tractors. Exchange of machines is not a very common practice as indicated by this study. It is most extensively utilized in the case of wagons, where one farmer exchanges labor as well as a team and wagon during threshing, corn picking and other seasonal tasks.

Of machines used on farms in addition to that of the owner, most are used on an average of about one other farm. Those used on the greatest number of other farms are generally used on a custom basis. For such machines the average number of other farms are: Field ensilage cutter, 19; corn sheller, 19; stationary ensilage cutter, 18; tractor cultivator, 7; wagon, 5; combine, 4; trailer, 4; tractor, 4; and cornpicker, 2.

Cooperative use of higher capacity machines may be extended advantageously as a labor saving measure and in fuller utilization of agricultural resources during a war emergency. A community pooling of machinery and labor can benefit the owner of the higher capacity machine as well as others. The following hypothetical example illustrates the advantage: Of two neighbors, one with 66 acres of corn has a two-row, horse-drawn cultivator and the other with 88 acres of corn has a two-row tractor-drawn cultivator. Assuming 11 acres for the horse machine and 22 for the tractor, the first will require 6 days and the second 4 days, or a total of 10 man-days to cultivate the 154 acres of corn. If the tractor cultivator alone is used, the 154 acres will be cultivated once over with 7 man-days. The saving of 3 man-days might be utilized on either farm in livestock production or other vital operations. Not only are labor requirements decreased, but tractor hours are also reduced. Fewer tractor hours required for cultivating

corn permits more time for grinding, combining and other practices.

If several farmers pooled labor and the higher capacity machines for all operations, the amount of labor freed for other operations might be very considerable. However, this practice should not be extended so far that it will interfere with the timeliness of operation, especially with those operations such as combining which must be performed during the dry period of the day.

During normal times the hiring of machines is often discouraged by the fact that the machine owner may hesitate to make a charge for the machine for fear that he be looked upon as a "tightwad." On the other hand, an individual who might be glad to rent the machine may hesitate to borrow it for fear of being looked upon as a "sponger." This resistance to cooperative use of machinery no doubt results in more machines on smaller farms than there otherwise might be. Lack of knowledge as to machine costs probably results in more machines being loaned which would otherwise be rented. There is need for more education relative to machine costs.

During the emergency there will of necessity be need for extended cooperative use of machines. Misunderstandings as to costs and charges should not act as a deterrent. A satisfactory arrangement may be found in dividing the total cost on the basis of use on each farm. Normal repairs from wear should be included along with interest, depreciation and all other costs.

COST OF MACHINE USE

From the data reported on life, repair costs and annual service, the total costs and cost per unit of service have been calculated on a basis of 1941 average retail prices (table 20). The prices used are an average of several and hence may not coincide exactly with that for any one make of machine. Items of annual cost include depreciation, interest, repairs, housing, insurance and taxes.

DEPRECIATION

The straight-line method of computing depreciation is used here in figuring the cost of using machines. This method consists of dividing the total anticipated depreciation by the number of years the machine is expected to last to find the depreciation for each year. The total depreciation is, of course, the purchase price minus the salvage or trade-in value when

the machine is finally discarded or traded in on a new one.

Few machines on Iowa farms are used to the point where only junk value remains. A majority of machines are traded in on new ones before they are completely worn out. For that reason a trade-in value of 10 percent has been used in figuring the cost of machines as given in table 20. For example, a two-row cornpicker costing $750 when new and expected to last 11 years would have an annual depreciation of $750 minus $75 divided by 11, or $61.36 per year.

When figured in this manner the annual depreciation charge as an absolute amount ranged from 93c for the two-wheel, home-made trailer to $84.85 for the 1½-ton truck. As a percentage of first cost, the depreciation charge ranged from 9.0 percent for the 5-foot combine to 3.2 percent for the wagon.

INTEREST

The interest rate used is 5 percent. Although this is less than is usually paid when machinery is purchased on credit arrangements, it is more than is paid on most long-term loans or less than could be realized by a farmer loaning his surplus funds during normal times.

It is assumed that dealers make an average concession of about 10 percent from list price of new machines in the form of trade-in value on old equipment. Consequently the annual interest charge has been figured on one-half the first cost minus 10 percent. For example if a two-row cornpicker costs $750 new, the annual interest charge is 5 percent of $750 minus $75 divided by 2, or $16.88 per year.

HOUSING, INSURANCE AND TAXES

Davidson and Henderson estimate that the annual cost of housing is 1.4 percent, insurance 0.2 percent and taxes 0.4 percent of the first cost of farm machines, or a total of 2 percent.[4] This is based upon an estimate that $1,500 invested in farm machinery of the types used in Iowa will require a storage building providing about 1,200 square feet of floor area. The estimated cost of the building is $300, and if it lasts 33 years at an interest rate of 5 percent, the total annual cost of housing, including provision for maintenance, insurance and taxes, will amount to 1.4 percent of the initial cost of the machines housed.

This combined cost of housing, insurance and taxes figured at 2 percent of the first cost is used in this study for all machines.

[4]Davidson, J. Brownlee and Henderson, S. Milton. Life service and the cost of service of machines on 400 Iowa farms. Iowa Agr. Exp. Sta.—Ext. Ser., Bul. P37. 1942.

REPAIRS

Repair costs constituted the smallest percentage of total annual costs as an average for all machines. The average for all machines was 1.8 percent of the initial cost. As a group, the repair cost for feed grinders was a greater percentage of the first cost than for other machines. Repair costs for rollers and spike-tooth harrows were lowest both as an absolute amount and as a percentage of first cost. Repair costs for all tractors were 1.3 percent of the first cost. Repair costs varied widely between individual machines of like makes and annual use. These variations are probably best explained by the differences in care, timeliness of repairs and lubrication, and to a lesser extent by annual use, age, type of soil and topography on which used.

TOTAL ANNUAL COST

Absolute total yearly expense ranged from $2.01 for the 7- to 11-foot spike-tooth harrow to $168.88 for the 1½-ton truck. Annual cost as a percentage of first cost averaged 10.9 percent for all machines and ranged from 8.0 percent for the 7- to 11-foot spike-tooth harrow and 7-foot grain drill to 20.8 percent for the hammer mill feed grinder of 80 bushel per hour capacity (table 20).

MACHINE COST PER UNIT OF SERVICE

From the total cost computed as described above, the average machine cost per unit of service exclusive of fuel, oil and grease was figured for all machines. Total annual service as expressed in table 12 was used to compute cost of service. These average machine costs are included in table 20.

RELATION OF ANNUAL SERVICE TO MACHINE COSTS

The greater part of total cost for most machines is probably of a fixed nature and does not vary a great deal with use. This may be explained by the fact that many machines are used only a short period during the year, which does not nearly approach the maximum use possible.

Another important factor in the cost of the machine over time is that of obsolescence. Actually, many machines become obsolete long before becoming worn out. An implement mounted on a tractor may become obsolete when the tractor wears out, regardless of condition of the implement. Obviously, this decrease in either operational or trade-in value results in a cost little related to annual use of the machine.

On the other hand, there are some elements of variable costs, although they probably make up a small proportion of the total. Table 21 indicates the total cost and the cost per unit of service for farms of different sizes. The machines included represent the common machines and those for which a large number were reported. In a few cases there is a marked difference in total costs, while in others there is not. In no case does the total cost differ greatly from the average for all machines indicated in table 20. Probably more important than the annual use is the care given to the individual machine. The costs for individual machines used approximately the same amount per year varied much more than the averages between those grouped according to use. As previously mentioned, the person using the machine the greater amount may be the one who gives it the better care. Inasmuch as such is the case, the exact effect of use on life and cost could be segregated only by grouping machines according to use and care.

Regardless of the fact that yearly costs of many machines of the same kind and type may not vary greatly with use, the cost per unit of service does. The large scale operator usually has an acreage great enough to realize an economy in the form of low costs per unit of service performed. As the scale of operation is increased, it is equivalent to overcoming the indivisibility of certain resources. The operator of 80 acres cannot use one-half of his tractor although it possesses excess capacity, but the operator of 160 acres can use the equivalent of one-half of his tractor on each 80 acres.

Table 21 indicates the lower machine costs realized by the large farm in performing an operation with a machine of specific size. This relationship probably holds true in most cases for the different farm operations but does not necessarily mean that each individual small farmer has higher machine costs per unit of service. The operator of the small farm may use a lower capacity machine near to its limit, whereas a somewhat larger operator may use a machine of increased size but use it less per dollar of its cost. However, the averages of table 21 emphasize the fact that the small farms are handicapped in having insufficient crops or other work to utilize machinery as fully as larger farms, unless their machines are used cooperatively or for custom work in addition to work on the home farm.

Machine cost per unit of service on a large number of the farms reporting was greater than if the operation was paid for on a custom basis. This was especially true in the case of farms less than 120 acres in size. Even more numerous were

the cases where the operator would have gained economically by hiring the machine while providing his own power. The fact that some operators may be content to own a machine which results in a higher cost per unit of service than if the operation were performed by a machine hired or rented is rooted in the desire to be independent of others. In many other cases such a situation probably prevails because the operator is not aware of the true machine cost per unit of service or because of the resistances to cooperative use as mentioned previously.

METHODS OF LOWERING MACHINE COSTS

Increased annual use of an implement is the most effective means of lowering unit service costs. However, indivisibility of the farmer's resources and an optimum combination of those he does control often prevent his attaining lower machine costs by increasing service on his own farm. Farm machines come in units of a given size while the scale of the given enterprise may necessarily be fixed by the size of the farm and combinations with other enterprises. In terms of economy it would be pointless to suggest that machine costs be lowered by greater annual service on the operator's farm if the optimum combination of the resources exists. However, where insufficient acreage prevents full use at home, cooperative use may aid in lowering costs per unit of service. Such may be accomplished through owning the implement jointly with others, by hiring the machine from the owner and furnishing the power, or by custom arrangements whereby the machine owner furnishes labor and power as well as the machine. Opportunity to lower costs in this manner is especially open to operators of small farms. The owner of the large farm may have enterprises of such a scale that he is already realizing a low cost per unit of service. In other cases where the scale of a single enterprise may be of a limited size, the larger operator may be unable to use implements cooperatively because timeliness of other operations dictates the use of labor and power.

Use of dependable second-hand equipment may make possible lower machine costs where it serves complementary to the type of power and farm enterprise. Again this opportunity is especially applicable to those farmers with limited resources and only a small amount of use for the implement. Larger operators may require more reliable machines or only those that fit certain makes and sizes of tractors. Care should be exercised in buying only serviceable machines.

Smaller sizes of machines usually give a lower machine

cost for a given amount of service than do larger ones. However, in deciding upon the size that is the most economical, the farmer must consider timeliness of operations and the cost of labor. These factors are discussed in an earlier part of this bulletin.

Since depreciation costs make up such a large proportion of the total costs, any extension in life through better care is important in lowering costs. Likewise, timeliness of repairs and lubrication is important in lowering total repair costs and hence affecting cost per unit of service.

TABLE 1. DISTRIBUTION OF FARMS ACCORDING TO SIZE AND TYPE OF FARMING AREA, SURVEY OF SEPTEMBER, 1941.

Farm size in acres	Northeast Dairy area	Eastern Livestock area	Cash Grain area	Western Livestock area	Southern Pasture area	State
0–40	8	11	15	11	39	84
41–120	119	167	144	231	202	863
121–200	189	218	304	319	197	1,227
201–280	51	78	109	126	89	453
281–360	24	40	73	71	32	240
361 and over	19	33	24	37	32	145
Total	410	547	669	795	591	3,012

TABLE 2. NUMBER OF MACHINES REPORTED IN SURVEY.

Machine, size	Horse-drawn	Tractor or other power	Machine, size	Horse-drawn	Tractor or other power
Combine, less than 5'	—	16	Manure spreader, less than 60 bu.	369	29
5'	—	73	60–70 bu.	932	129
6'	—	92	over 70 bu.	286	59
8'	—	8	size not ind.	86	11
Cornpicker, 1–row	—	162	Milking machine	—	117
2–row	—	366	Mower, 5' & less	1,266	20
Corn planter, 2–row	2,466	109	6'	1,012	46
4–row	—	31	7'	46	160
Corn sheller, under 60 b.p.h.	—	45	8'	10	4
61–100 b.p.h.	—	43	size not indicated	11	6
over 100 b.p.h.	—	61	Plow, 18" & less	823	233
size not ind.	—	13	19"–36"	202	1,405
Cultivator, 1–row	2,188	8	over 36"	9	154
2–row	537	1,512	Rake, dump	903	13
4–row	—	25	side delivery	656	50
Disk, single, 8' & less	454	71	sweep	38	4
9'–10'	470	451	kind not indicated	267	
11'–15'	52	440	Roller, 8' & less	33	25
16' & over	21	63	9'–12'	39	89
size not ind.	—	14	13' & over	23	98
Disk, double, 7' & less	18	79	size not indicated	4	4
8'	31	114	Seeder, 7' & less	44	—
9'	8	18	8'–9'	48	—
10' & over	38	200	10'–11'	213	1
size not ind.	3	—	12'–14'	48	1
Ensilage cutter, field	—	17	15'–20'	107	1
stationary	—	159	21' & over	1,124	29
Feed grinder, hammer mill, 40 b.p.h. & less	—	55	Spike tooth harrow, 7'–11'	222	16
41–80	—	218	12'–15'	405	134
81 & over	—	67	16'–19'	293	183
plate, 40 b.p.h. & less		156	20 '& over	500	791
41–80	—	245	Spring tooth harrow, 7'–9'	30	106
81 & over	—	58	10'–12'	29	77
size or kind not ind.	—	132	13' & over	13	35
Grain binder, 6'	159	45	Tractor, row crop	—	1,729
7'	157	51	4–wheel	—	516
8'	560	475	Trailer, 2–wheel homemade	—	417
9'–10'	22	249	4–wheel homemade	—	356
size not ind.	12		2–wheel fact. made	—	9
Grain elevator	—	1,095	4–wheel fact. made	—	48
Grain drill, 7' & less	74	14	Truck under 1 ton	—	175
8'–9'	110	25	1–2 tons	—	213
10'–11'	49	31	2–4 tons	—	19
12' & over	18	5	4 tons and over	—	16
Hay loader	870	260	Wagon	4,790	—

TABLE 3. NUMBER OF POWER-OPERATED MACHINES PER 100 FARMS BY TYPE OF FARMING AREA AND SIZE OF FARM.

Machine, size	Type of farming area					Size of farm in acres						
	Northeast Dairy	Eastern Livestock	Cash Grain	Western Livestock	Southern Pasture	0–40	41–120	121–200	201–280	281–360	361 & over	All farms
Combine less 5'	1.2	1.6	0.2	0	0.2	0	0.4	0.3	0.9	1.3	1.3	0.5
5'	3.2	4.2	0.9	2.4	2.0	1.3	1.1	2.2	2.7	7.1	4.7	2.4
6'	0.7	2.4	6.3	3.0	1.7	0	1.5	2.4	5.8	5.4	6.7	3.1
Cornpicker 1–row	10.5	4.6	6.3	4.9	2.2	0	3.3	6.1	8.0	6.3	5.3	5.4
2–row	6.3	17.5	23.7	9.4	1.7	2.5	4.2	10.0	17.8	30.4	34.7	12.2
Corn planter, tractor 2–row	1.0	3.0	4.0	7.4	2.6	1.1	2.2	2.6	5.7	5.2	17.7	3.9
4–row	1.8	0.9	2.8	0.4	0	0	0.2	0.4	2.2	3.0	5.4	1.1
Corn sheller less 60 b.p.h.	0.2	1.8	1.6	1.1	2.4	0	1.4	1.5	2.4	0.8	1.3	1.5
60–70 b.p.h.	2.7	1.3	1.2	1.5	0.9	0	1.2	1.6	0.7	2.9	2.0	1.4
over 70 b.p.h.	2.0	1.5	1.6	3.5	1.0	0	0.5	2.4	3.8	3.8	1.3	2.0
Cultivator 2–row	48.9	63.6	74.3	56.4	27.0	8.9	31.7	54.8	68.9	77.0	93.9	53.8
4–row	2.2	0.2	1.7	0.6	0	0	0.1	0.4	2.0	1.7	5.4	0.9
Disk, single 8'	2.0	3.2	1.5	1.6	3.8	1.1	2.9	2.0	3.3	1.3	3.9	2.5
9'–10'	12.0	22.1	18.5	19.4	8.2	1.1	12.3	18.8	17.6	15.2	13.1	16.1
11'–15'	10.0	10.5	34.3	19.7	3.4	1.1	4.0	15.6	23.1	33.9	35.4	15.7
16'	2.4	1.1	6.0	1.5	0.5	0	1.2	1.9	2.9	3.9	7.7	2.2
Disk, double 7'	2.8	9.6	0.2	0.3	2.7	0	2.1	3.3	2.7	1.3	6.9	2.8
8'	4.1	6.8	3.4	2.0	4.2	1.1	2.1	4.1	5.8	5.2	8.5	4.1
9'	0.4	1.1	0.6	0.4	0.7	0	0.6	0.4	0.7	1.7	1.5	0.6
10'	13.1	7.1	6.6	4.2	5.1	0	4.3	6.4	9.8	11.7	15.4	7.1
Ensilage cutter, field	0.5	0.4	0.8	0.9	0.2	0	0.2	0.2	1.1	1.7	2.0	0.6
stationary	14.4	4.0	4.9	4.5	1.5	0	2.2	5.5	6.9	9.2	12.7	5.3
Grain binder 6'	2.4	1.6	1.5	0.9	1.6	0	1.8	1.3	1.3	1.7	3.1	1.6
7'	2.6	2.1	0.6	2.2	1.5	0	1.3	1.8	3.1	0.9	3.1	1.8
8'	17.3	16.1	36.2	12.0	6.0	0	8.3	18.9	24.9	22.2	21.5	16.9
9'–10'	5.3	10.2	11.5	11.9	4.6	0	3.7	7.8	8.7	22.2	30.0	8.9
Grain drill 7'	0	0	0.6	0.7	0.8	1.1	0.1	0.1	1.6	0.9	1.5	0.5
8'–9'	0.2	0.5	0.2	1.6	1.4	0	0.3	0.3	2.0	2.6	3.1	0.9
10'–11'	0	0.9	1.1	2.2	0.8	0	0.2	0.9	1.3	2.6	5.4	1.1
12'	0.2	0.2	0	0.4	0	0	0.1	0	0	0	3.1	0.2
Grain elevator	14.2	34.9	73.9	39.0	6.4	2.5	19.1	41.5	46.2	55.4	52.0	36.4
Hay loader	14.7	5.7	6.0	6.1	6.0	0	4.4	7.8	10.7	12.6	11.5	7.8
Manure spreader	15.3	7.5	13.0	6.8	4.1	2.2	4.4	7.5	8.2	14.4	16.9	7.7

TABLE 3. NUMBER OF POWER-OPERATED MACHINES PER 100 FARMS BY TYPE OF FARMING AREA AND SIZE OF FARM.—(Cont.)

Machine, size	Type of farming area					Size of farm in acres						
	Northeast Dairy	Eastern Livestock	Cash Grain	Western Livestock	Southern Pasture	0–40	41–120	121–200	201–280	281–360	361 & over	All farms
Milking machine	10.7	3.6	5.4	1.6	0.5	0	2.8	3.9	4.7	10.4	5.3	3.9
Mower 5'	0.6	0	1.1	1.2	0.4	1.1	0.9	0.6	0.7	0.4	0	0.7
6'	0	4.6	1.7	1.0	1.4	0	1.7	1.0	2.4	3.0	1.5	1.6
7'	4.1	8.0	4.7	7.0	4.2	0	2.2	3.6	8.4	13.9	23.1	5.7
8'	0.4	0.2	0.2	0	0	0	0	0	0.4	0	1.5	0.1
Plow less than 18"	6.7	15.7	4.7	8.0	6.8	2.2	8.1	7.5	9.8	6.1	13.9	8.3
18"–36"	44.5	50.2	67.6	55.1	29.6	10.0	31.2	55.9	59.3	61.7	64.6	50.0
36" & over	8.0	6.1	7.9	3.9	2.3	0	1.8	4.2	9.8	11.3	16.2	5.5
Roller 8" & less	0	0.2	1.7	0.1	1.9	1.1	0.3	0.7	2.0	0.9	1.5	0.9
9"–12"	1.4	5.5	4.7	3.3	1.4	0	1.7	3.3	3.3	5.7	6.9	3.1
13" & over	0	4.8	6.8	5.4	0.5	0	1.4	3.2	3.8	7.8	11.5	3.4
Seeder	1.0	2.1	1.9	0.7	0.4	4.4	1.4	0.5	1.1	2.2	—	1.1
Spike harrow 7'–11'	0.6	0.7	0	0.7	0.7	0	0.8	0.6	0.4	0	0	0.6
12'–15'	4.5	5.9	3.0	3.0	6.5	1.1	4.7	4.0	8.0	2.6	3.9	4.6
16'–19'	3.3	8.6	7.2	7.4	5.3	1.1	4.9	5.9	7.6	10.4	10.8	6.3
Over 20'	27.7	30.5	47.6	27.5	10.0	3.3	12.9	30.9	36.4	41.7	51.5	27.2
Spring tooth harrow 7'–9'	6.9	1.8	10.4	0.9	0.3	0	1.7	4.1	5.6	5.2	6.2	3.6
10'–12'	2.9	1.6	6.6	2.8	0.1	0	0.6	2.6	4.2	6.1	7.7	2.7
13' & over	1.4	1.4	3.4	0.4	0.1	0	0.6	1.0	1.6	3.0	3.9	1.2
Tractor, 4–wheel	21.0	14.0	29.0	13.7	14.0	7.1	15.3	19.2	22.5	17.5	22.8	18.3
row–crop	53.2	72.0	65.2	63.0	31.0	15.5	37.3	59.1	72.2	87.9	93.1	57.5
Truck less than 1 ton	4.9	9.1	4.2	4.5	7.0	11.3	4.8	4.7	6.9	8.3	10.7	5.8
1–2 ton	6.1	8.2	8.5	8.0	3.7	12.5	4.3	4.9	10.7	10.8	21.3	7.1
over 2 ton	0.5	1.5	1.0	0.9	0.2	1.3	0.2	0.9	0.7	1.7	2.7	1.2
Trailer, 2–wheel, homemade	19.8	18.0	15.5	8.9	10.5	11.3	13.7	15.2	13.1	10.0	13.3	13.9
4–wheel, homemade	13.7	12.4	18.8	9.4	5.3	6.3	8.6	12.5	12.0	20.4	13.3	11.8
2–wheel, factory	0.2	0.2	0.3	0.1	0.7	—	0.6	0.2	0.4	—	—	0.3
4–wheel, factory	1.5	0.4	5.4	0.3	0.3	3.8	1.6	1.5	1.6	1.7	0.7	1.6

TABLE 4. NUMBER OF HORSE-DRAWN MACHINES PER 100 FARMS BY TYPE OF FARMING AREA AND SIZE OF FARM.

Machine, size	Type of farming area					Size of farm in acres						
	Northeast Dairy	Eastern Livestock	Cash Grain	Western Livestock	Southern Pasture	0–40	41–120	121–200	201–280	281–360	361 & over	All farms
Corn planter 2-row	84.7	90.0	87.6	82.0	82.2	60.0	81.5	89.6	86.9	86.5	77.7	87.8
Cultivator 1-row	63.7	52.5	72.5	80.1	93.9	81.1	68.4	75.8	76.7	83.0	97.7	77.9
2-row	17.3	35.9	11.1	24.6	8.4	8.9	20.2	19.5	14.4	18.7	19.2	19.1
Disk, single, 8'	18.0	14.8	4.2	10.1	27.7	34.4	23.5	13.0	9.6	7.0	10.0	16.2
9'–10'	10.8	13.0	16.2	23.2	15.1	7.8	22.6	16.2	10.0	13.0	6.1	16.7
11'–15'	2.0	1.4	1.3	1.6	2.4	1.1	1.6	1.9	2.2	0.9	3.1	1.9
16'	0.6	0.7	0.8	1.0	0.5	1.1	1.0	0.7	0.4	0.4	0	0.8
Disk, double 7'	1.2	2.1	0	0	0.4	0	0.8	0.8	0.4	—	—	0.6
8'	1.8	0.9	0	0.1	2.3	2.2	1.0	1.2	0.4	1.7	0.8	1.1
9'	—	0.5	0.4	0.1	0.4	0	0.2	0.4	0.2	—	0.8	0.3
10' & over	1.2	0.2	0.6	1.2	2.7	1.1	1.0	1.4	1.6	1.7	0.8	1.4
Grain binder 6'	12.0	7.1	0.4	3.2	5.8	1.1	8.7	5.0	3.8	2.6	2.3	5.7
7'	5.9	4.1	0	9.1	6.2	1.1	4.7	6.7	6.2	3.5	2.3	5.6
8'	21.0	24.3	24.3	19.3	11.4	5.6	14.4	23.3	22.2	18.3	19.2	19.9
9'–10'	0.8	0	0	0.9	1.6	0	0.7	1.0	0.9	0.4	0	0.8
Grain drill 7'	1.4	3.4	1.1	2.3	4.1	3.3	2.1	2.1	2.9	3.0	6.9	2.6
8'–9'	2.9	3.6	1.3	4.2	5.8	1.1	2.5	3.0	6.4	6.1	7.7	3.9
10'–11'	0.8	1.6	1.5	2.0	2.2	2 2	0.9	1.6	1.3	2.6	6.9	1.7
12'	1.2	0.9	0.2	0.9	0.1	0	0.5	0.6	1.1	0	1.5	0.6
Hay loader	42.0	47.5	26.4	26.5	15.7	5.6	21.8	30.4	40.0	37.4	43.9	31.0
Manure spreader	67.5	61.4	64.2	56.7	82.6	15.6	44.5	58.8	61.6	67.0	70.0	56.4
Mower 5'	63.3	21.8	51.7	50.4	33.1	33.3	50.9	44.5	39.8	34.8	23.9	45.1
6'	22.4	31.6	28.1	29.0	43.1	25.6	27.9	37.5	35.3	40.9	53.1	36.0
7'	2.0	3.2	0.9	1.2	1.6	1.1	1.0	2.0	1.6	2.6	0.8	1.6
8'	0.6	0	0.2	0.1	0.8	2.2	0.7	0.2	0	0	—	0.4
Plow less than 18"	22.9	26.6	20.6	24.6	41.9	42.2	38.6	25.1	20.0	16.5	28.5	29.3
18"–36"	11.2	5.0	3.2	9.4	5.5	2.2	8.5	7.6	5.3	5.2	3.1	7.2
36" & over	0.2	1.8	0	0	0	0	0.5	0.1	0.4	0.4	0.8	0.3
Roller 8" & less	1.0	2.1	1.1	0.6	1.2	0	0.7	1.0	2.2	0.9	3.1	1.1
9"–12"	0.8	2.5	0.4	2.2	1.0	0	1.0	1.0	1.6	3.0	3.9	1.3
13" & over	0	0	0.2	3.2	0	0	0.5	0.9	0.7	1.3	2.3	0.8
Seeder 7' & less	6.9	1.1	0	0.4	0.1	4.4	2.3	1.2	1.3	0.4	0	1.5
8'–9'	5.9	1.4	0.2	1.3	0.3	0	1.7	1.8	1.6	1.7	1.5	1.7
10'–11'	9.0	13.6	1.1	13.5	1.1	4.4	7.2	8.6	6.4	6.1	4.6	7.3

TABLE 4. NUMBER OF HORSE-DRAWN MACHINES PER 100 FARMS BY TYPE OF FARMING AREA AND SIZE OF FARM.—(Continued)

Machine, size	Type of farming area					Size of farm in acres						
	North-east Dairy	Eastern Live-stock	Cash Grain	West-ern Live-stock	South-ern Pasture	0–40	41–120	121–200	201–280	281–360	361 & over	All farms
Seeder 12'–14'	2.2	1.8	0.2	2.3	1.6	0	1.6	1.2	2.7	3.5	0	1.7
15'–20'	5.1	5.7	0.8	4.1	3.2	0	2.9	4.2	4.2	5.2	3.1	3.7
21' & over	29.6	36.6	57.0	33.8	37.4	11.1	29.9	41.5	46.2	45.7	55.4	38.6
Spike harrow 7'–11'	9.4	2.5	1.1	2.9	18.5	35.6	12.2	4.3	3.8	6.1	3.9	7.6
12'–15'	15.5	10.0	4.9	11.3	24.1	28.9	20.9	10.7	10.9	6.5	9.2	13.9
16'–19'	4.3	15.0	3.6	10.9	15.0	6.7	14.3	10.0	7.8	5.2	2.3	10.1
Over 20'	14.5	16.4	21.1	27.1	7.4	1.1	14.9	20.9	16.0	17.4	16.2	17.2
Spring tooth harrow 7'–9'	2.8	0.9	1.3	0.3	0.4	—	0.7	0.7	1.8	2.6	1.5	1.0
10'–12'	2.4	0.2	1.1	1.2	0.3	1.1	0.7	0.8	1.3	2.2	1.5	1.0
13' & over	0.4	0.5	0	0.9	0.4	--	0.9	0.4	0.2	—	—	0.5

TABLE 5. MACHINERY DENSITY PER 1,000 ACRES OF FARM LAND, BY TYPE OF FARMING AREA AND SIZE OF FARM.*

Machine	Type of farming area					Size of farm in acres					
	North-west Dairy	Eastern Live-stock	Cash Grain	West-ern Live-stock	South-ern Pasture	0–40	41–120	121–200	201–280	281–360	361 & over
Combine, feet	1.4	2.2	3.0	2.0	.9	1.8	1.6	1.7	2.3	2.4	1.8
Cornpicker, rows	1.1	2.7	3.7	1.5	.3	1.4	1.2	1.7	1.8	2.2	1.7
Corn planter, rows, horse	10.0	9.9	9.4	8.7	9.4	38.6	17.2	10.8	7.1	5.5	3.0
Corn planter, rows, tractor	.5	.5	1.0	.9	.3	.7	.6	.3	.8	.7	1.1
Corn sheller (no)	0.2	.3	.3	.4	.2	.0	.3	.4	.3	.2	.1
Cultivator, horse, rows	5.8	6.8	5.1	6.9	6.4	32.1	11.4	7.0	4.8	3.8	2.6
Cultivator, tractor, rows	6.2	7.1	8.4	6.5	3.1	5.7	6.7	6.8	6.0	5.1	4.1
Disk, single, ft., horse	16.3	13.8	11.7	17.9	22.5	119.2	45.6	17.5	8.2	6.2	3.3
Disk, single, ft., tractor	18.1	21.7	40.9	25.7	9.3	11.1	22.6	26.3	22.7	21.4	14.9
Disk, double, horse, ft.	2.0	1.5	.5	.7	2.8	18.9	2.5	1.9	1.2	1.1	.4
Disk, double, tractor, ft.	11.0	11.1	5.4	3.4	6.3	2.8	8.3	7.0	6.9	5.8	5.5
Ensilage cutter (no.)	.7	.4	.5	.4	.0	.32	.36	.37	.40	.34	.38
Grinder (no.)	1.3	3.1	1.9	2.3	.6	2.1	2.0	2.1	1.6	3.9	1.3
Grain binder, ft., horse	17.0	14.6	10.5	12.6	10.3	18.9	21.1	16.1	19.2	6.4	3.7
Grain binder, ft., tractor	13.1	14.0	22.5	12.5	6.5	.0	12.9	15.1	12.3	13.1	9.9
Grain drill, horse, ft.	3.3	4.5	2.0	4.5	5.8	18.2	5.4	3.9	4.2	3.2	3.9
Grain drill, tractor, ft.	.3	.9	.9	2.5	1.5	.0	.8	.9	1.7	1.8	2.6
Grain elevator	.7	2.4	5.0	2.4	.3	.7	2.0	2.7	1.9	1.8	1.2
Hay loader (no.)	3.3	2.9	1.7	1.7	1.2	.0	2.8	2.3	2.1	1.6	1.1
Manure spreader (no. mach.)	4.4	3.8	4.2	3.4	2.1	5.7	5.1	4.0	3.0	2.4	1.7
Mower, ft., horse	27.6	17.7	23.4	25.0	25.9	105.4	46.6	28.9	16.8	14.2	8.7
Mower, ft., tractor	2.1	3.8	2.7	3.2	2.2	1.8	3.1	2.1	3.3	3.7	3.5
Plow, bottom, horse	2.7	3.6	1.5	2.3	3.1	15.0	6.0	2.5	1.5	.9	.7
Plow, bottom, tractor	7.0	7.4	8.8	6.9	4.2	7.1	8.0	8.1	6.5	5.2	3.7
Roller, horse, ft.	.9	2.2	.8	3.8	1.1	.0	2.3	1.8	1.6	1.8	1.9
Roller, tractor, ft.	.9	6.9	8.5	4.1	2.1	2.9	4.2	5.1	4.3	5.6	4.7
Seeder, ft.	60.7	67.2	81.4	56.4	53.8	103.4	93.3	74.6	54.0	44.2	29.1
Sp. tooth harrow, horse, ft.	42.2	62.2	34.8	54.2	54.0	274.3	105.1	52.1	28.8	15.1	11.3
tractor, ft.	57.8	53.2	70.5	44.5	24.2	37.1	48.8	54.7	45.9	38.5	11.3
Sp. tooth harrow, horse, ft.	3.0	.9	1.2	1.4	.7	3.9	2.6	1.2	1.3	1.4	.6
tractor, ft.	6.2	2.7	10.6	2.3	.3	.0	2.6	4.5	4.6	4.8	3.6
Tractor, 4–wheel (no.)	1.0	1.0	2.0	.8	.6	2.1	1.6	1.3	.9	.6	.5
Tractor, row-crop (no.)	2.0	3.6	3.1	3.2	1.2	5.7	2.8	3.1	2.2	2.3	1.5
All tractors, (no.)	3.0	4.6	5.1	4.0	1.8	7.8	4.4	4.4	3.1	2.9	2.0
Wagons, (no.)	4.6	11.0	10.9	11.7	6.6	52.5	14.2	10.0	7.4	7.0	4.4

*Machine figured as average size where size not indicated.

TABLE 6. PERCENT OF LAND AS HARVESTED CROPS IN IOWA, 1940.*

Size of farm	Percent	Type of farming area	Percent
3–49 acres	42.24	Northeast Dairy	59.05
50–139	58.53	Eastern Livestock	56.34
140–219	61.46	Cash Grain	68.25
220–379	59.41	Western Livestock	62.19
380 & over	51.65	Southern Pasture	45.20
State average	58.79		

*Source, 1940 Census.

TABLE 7. AVERAGE MACHINERY INVESTMENT PER FARM AND PER ACRE IN IOWA, 1940.*

Acres in farm	Machinery investment per farm	Machinery investment per acre
3–49	$ 244	$12.67
50–139	768	7.85
140–219	1,281	7.54
220–379	1,794	6.54
380 and over	2,747	5.32

*Source, 1940 Census.

TABLE 8. PRESENT AGE, ESTIMATED TOTAL LIFE AND ANNUAL SERVICE BY FARM SIZE.

Farm size acres	Present age						Estimated total life, years						Annual acres used					
	0–40	41–120	121–200	201–280	281–360	361 & over	0–40	41–120	121–200	201–280	281–360	361 & over	0–40	41–120	121–200	201–280	281–360	361 & over
MACHINE, POWER, SIZE																		
Combine 5'	*	6.8	6.9	5.2	7.0	8.0	*	9.8	10.2	8.5	10.0	11.1	*	151.7	143.5	174.9	199.9	140.0
Cornpicker, 1–row	*	7.3	7.7	9.2	7.5	5.2	*	14.1	13.1	14.5	11.5	9.6	*	45.8	66.7	89.3	92.3	71.4
Cornpicker, 2–row	*	4.6	4.8	4.4	3.7	3.5	*	11.3	10.6	11.2	10.6	10.7	*	144.8	164.7	156.4	170.6	172.3
Corn planter, horse, 2–row	18.5	14.7	15.2	13.2	12.2	11.2	25.8	24.1	24.7	23.0	23.9	21.9	15.1	34.4	51.3	66.9	89.6	92.6
Cultivator, horse, 1–row	15.0	14.4	14.5	14.5	14.9	13.1	22.5	22.4	22.9	22.4	22.5	22.4	28.6	55.5	60.1	73.4	68.7	82.7
Cultivator, horse, 2–row	16.2	12.6	11.9	10.9	10.6	9.8	21.6	20.9	20.2	20.0	19.1	19.3	34.8	81.6	102.3	132.8	139.4	81.5
Cultivator, tractor, 2–row	7.2	5.9	4.9	5.2	4.5	4.8	19.8	17.4	16.2	16.2	15.4	17.0	99.0	118.3	177.2	203.9	269.7	288.3
Disk, horse 9'–10'	14.5	13.1	13.6	12.8	13.4	6.8	20.7	22.0	22.0	22.0	21.4	19.2	40.3	92.1	143.5	140.3	211.3	388.0
Disk, tractor 9'–10'	*	11.7	10.4	10.8	8.7	4.1	*	21.1	19.2	19.7	18.6	7.3	*	148.0	181.1	222.2	245.1	151.9
Grain binder, horse, 8'	23.6	15.5	15.5	14.6	14.7	15.8	27.4	22.8	22.6	22.3	21.6	23.1	10.8	28.9	41.2	52.3	62.4	56.9
Grain binder, tractor, 8'	*	15.8	13.6	12.9	11.2	11.5	*	22.8	21.2	21.5	19.8	21.0	*	31.4	50.4	68.0	78.8	80.7
Mower, horse, 5'	18.4	14.9	14.7	14.5	13.1	10.2	26.8	20.0	22.5	23.5	23.0	21.7	17.8	23.9	30.3	36.6	40.5	75.8
Mower, tractor, 7'	*	2.8	3.8	3.5	3.8	5.2	*	16.2	15.6	17.0	14.8	17.4	*	69.3	63.1	84.0	70.9	131.8
Plow, horse, 18" & less	16.9	17.0	16.4	15.6	15.1	16.8	25.3	26.0	24.8	24.6	23.1	26.4	7.5	19.8	19.0	26.5	27.8	38.7
Plow, tractor, 19"–36"	5.4	7.9	6.8	6.0	5.0	5.5	18.0	18.7	17.7	17.3	16.0	16.2	15.8	47.2	62.2	79.5	109.8	129.2
Tractor, row-crop	5.1	5.3	5.0	4.5	4.3	3.9	12.1	13.1	12.5	13.0	11.9	10.6	—	—	—	—	—	—
Tractor, 4–wheel	9.0	9.0	9.0	8.6	7.7	9.0	15.3	14.9	15.1	15.2	14.2	15.0	—	—	—	—	—	—

*Number of cases too few.

TABLE 9. PRESENT AGE AND ESTIMATED LIFE OF MACHINES.

Machine	Power, size	Present age	Estimated life	Percent present age is of estimated life
Combine	Under 5'	2.2	11.1	19.8
	5'	3.1	9.9	31.3
	6'	3.2	11.6	27.6
Cornpicker	1-row	7.8	13.3	58.6
	2-row	4.3	10.8	39.8
Corn planter	horse, 2-row	12.1	21.4	56.5
	tractor, 2-row	6.3	18.4	34.2
	tractor, 4-row	3.1	14.9	20.8
Corn sheller	60 bu. & less	12.4	21.3	58.2
	61-100 bu.	11.8	18.7	63.1
	100 bu. & over	12.4	20.5	60.5
Cultivator	horse, 1-row	14.4	22.6	63.7
	horse, 2-row	11.9	20.3	58.6
	tractor, 2-row	5.1	16.4	31.1
	tractor, 4-row	3.4	19.0	17.9
Disk, single	horse, 8' & less	15.7	23.4	67.1
	9'-10'	13.2	21.9	60.3
	11'-15'	12.2	22.9	53.3
	16' & over	13.6	22.0	61.8
	tractor, 8' & less	11.8	20.4	57.8
	9'-10'	10.4	19.2	54.2
	11'-15'	5.1	17.9	28.5
	16' & over	6.0	18.4	32.6
Disk, double	horse, 7'	12.5	20.0	62.5
	horse, 8'	14.6	22.4	65.2
	9'	15.2	22.8	66.7
	10' & over	11.9	23.1	51.5
	tractor, 7'	8.2	17.4	47.1
	8'	7.6	18.5	41.1
	9'	10.1	19.1	52.9
	10' & over	9.2	20.3	45.3
Ensilage cutter	field	5.7	14.2	40.1
	stationary	10.1	18.5	54.6
Feed grinder	hammer, under 40 bu.	6.3	16.6	40.0
	40-80 bu.	5.4	16.0	33.8
	81 & over	4.5	14.3	31.5
	plate, 40 bu. & less	12.3	19.5	63.1
	41-80	10.3	18.5	55.7
	81 & over	8.2	17.4	47.1
Grain binder	horse, 6'	20.0	27.0	74.1
	7'	19.1	25.3	75.5
	8'	15.4	22.6	68.1
	9'-10'	14.5	22.8	63.6
Grain elevator		14.9	25.0	59.6
Grain binder	tractor, 6' & less	15.5	21.7	71.4
	7'	16.1	22.9	70.3
	8'	13.4	21.3	62.9
	9'-10'	7.4	18.1	40.9
Grain drill	horse, 7'	19.2	27.0	71.1
	8'-9'	15.6	24.2	64.5
	10'-11'	16.7	23.9	69.9
	12' & over	13.1	24.5	53.5
Grain drill	tractor, 7'	17.5	25.7	68.1
	8'-9'	14.7	25.0	58.8
	10'-11'	12.0	22.3	53.8
	12' & over	12.7	23.0	55.2
Hay loader	horse	11.1	20.9	53.1
	tractor	9.2	20.3	45.3
Manure spreader	horse, 50 bu. & less	13.9	22.3	62.3
	60-70 bu.	11.1	20.3	54.7
	over 70 bu.	10.9	20.4	53.4
	tractor, 50 bu. & less	9.9	19.2	51.6
	60-70	8.3	19.7	42.1
	70 & over	8.8	19.4	45.4

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TABLE 9. PRESENT AGE AND ESTIMATED LIFE OF MACHINES—(Continued)

Machine	Power, size	Present age	Estimated life	Percent present age is of estimated life
Milking machine	1–set	5.3	15.4	34.4
	2–set	3.9	22.6	17.3
	3–set	10.3	22.0	46.8
Mower	horse, 5' & less	14.6	26.3	55.5
	6'	11.6	21.4	54.2
	7'	11.8	20.8	56.7
	8'	8.9	16.2	54.9
	tractor, 5' & less	10.9	21.8	50.0
	6'	12.6	19.7	64.0
	7'	3.9	17.5	22.3
	8'	7.8	19.0	41.1
Plow	horse, 18" & less	16.6	25.5	65.1
	19"–36"	15.4	24.6	62.6
	36" & over	13.3	20.3	65.5
	tractor, 18" & less	6.2	17.4	35.6
	19"–36"	6.6	17.6	37.5
	36" & over	7.6	19.4	39.2
Rake	horse, dump	16.5	24.8	66.5
	side delivery	10.7	21.6	49.5
	sweep	16.7	27.3	61.2
	tractor, dump	15.9	24.3	65.4
	side delivery	8.2	20.9	39.2
	sweep	15.8	24.5	64.5
Roller	horse, 8' & less	12.7	22.7	55.9
	9'–12'	13.7	25.6	53.5
	13' & over	11.7	21.5	54.4
	tractor, 8' & less	11.6	22.1	52.5
	9'–12'	10.2	21.7	47.0
	13' & over	8.3	21.5	38.6
	horse, 7' & less	16.6	24.7	67.2
	8'–9'	16.2	24.3	66.7
	10'–11'	15.1	22.9	65.9
	12'–14'	15.5	21.3	72.8
	15'–20'	10.8	18.8	57.4
	21' & over	12.0	21.9	54.8
	tractor, 21' & over	9.7	21.0	46.2
Spike harrow	horse, 7'–11'	16.8	25.6	65.6
	12'–15'	15.4	25.3	60.9
	16'–19'	14.8	24.4	60.7
	20' & over	14.2	23.8	59.7
	tractor, 7'–11'	10.8	23.5	46.0
	12'–15'	14.0	24.3	57.6
	16'–19'	13.2	23.4	56.4
	20' & over	11.4	22.1	51.6
Spring tooth harrow	horse, 4' & less			
	5'–6'			
	7'–9'	8.5	19.9	42.7
	10'–12'	10.2	22.1	46.2
	13' & over	17.2	24.4	70.5
	tractor, 7'–9'	6.5	20.3	32.0
	10'–12'	7.6	19.5	39.0
	13' & over	7.7	20.2	38.1
Tractor	4–wheel	8.8	15.0	58.7
	row crop	4.8	12.5	38.4
Trailer	2–wheel homemade	6.6	14.7	44.9
	4–wheel homemade	5.4	14.7	36.7
	4–wheel factory made	4.0	17.9	22.3
Trucks	under 1 ton	5.2	10.9	47.7
	1–2 ton	7.8	12.8	60.9

TABLE 10. AGE DISTRIBUTION OF MACHINES BY PERCENTAGE.

Type of power	Horse drawn													Tractor or other power											
Age of machine	1	2	3	4–6	7–9	10–12	13–17	18–22	23–27	28–32	33–37	38–42	43 & over	1	2	3	4–6	7–9	10–12	13–17	18–22	23–27	28–32	33–37	38–42	43 & over
MACHINE																									
Combine	—	—	—	—	—	—	—	—	—	—	—	—	—	22.0	17.6	25.6	29.6	3.2	1.2	0.8	—	—	—	—	—	—
Cornpicker, 1-row	—	—	—	—	—	—	—	—	—	—	—	—	—	11.6	3.9	9.7	20.0	11.6	26.5	13.5	2.6	0.6	—	—	—	—
2-row	—	—	—	—	—	—	—	—	—	—	—	—	—	12.3	14.3	22.9	34.5	7.7	6.9	1.4	—	—	—	—	—	—
Corn planter, 2-row	3.6	3.5	5.1	13.3	11.1	23.6	18.1	13.6	4.2	2.4	0.8	0.7	—	15.5	15.5	7.3	26.3	12.7	10.9	10.0	0.9	0.9	—	—	—	—
4-row	—	—	—	—	—	—	—	—	—	—	—	—	—	14.8	37.1	22.2	25.9	—	—	—	—	—	—	—	—	—
Corn sheller	—	—	—	—	—	—	—	—	—	—	—	—	—	8.4	6.5	6.5	11.0	7.1	17.4	12.3	19.1	6.5	2.6	1.9	.7	—
Cultivator, 1-row	0.9	0.8	1.9	8.4	9.2	25.3	24.7	17.6	7.4	2.3	0.8	0.6	0.1	—	—	71.4	—	—	—	14.3	14.3	—	—	—	—	—
2-row	0.9	1.4	2.7	13.2	11.9	30.4	22.4	13.0	2.5	1.6	—	—	—	12.2	9.6	15.3	43.5	8.1	6.8	3.2	0.5	0.3	0.3	0.1	0.1	—
4-row	—	—	—	—	—	—	—	—	—	—	—	—	—	16.0	28.0	16.0	28.0	8.0	4.0	—	—	—	—	—	—	—
Disk, single	1.6	0.5	1.3	8.9	7.6	27.0	23.6	19.5	6.8	2.4	0.4	0.3	0.1	11.5	7.8	12.6	27.6	9.0	16.4	7.5	5.0	1.6	0.8	0.1	0.1	—
Disk, double	—	—	2.4	10.6	10.6	29.3	24.7	11.8	9.4	1.2	—	—	—	9.5	8.7	6.6	25.7	9.7	18.7	13.9	5.8	1.1	0.3	—	—	—
Ensilage cutter, field	—	—	—	—	—	—	—	—	—	—	—	—	—	11.8	5.9	5.9	41.2	17.5	11.8	5.9	—	—	—	—	—	—
stationary	—	—	—	—	—	—	—	—	—	—	—	—	—	3.8	1.3	5.7	32.3	8.2	24.1	9.5	7.0	6.3	0.6	0.6	0.6	—
Feed grinder, hammer mill	—	—	—	—	—	—	—	—	—	—	—	—	—	19.3	13.7	12.6	27.3	8.4	10.9	3.9	2.8	0.8	—	0.3	—	—
plate	—	—	—	—	—	—	—	—	—	—	—	—	—	3.8	4.2	4.6	19.6	6.7	26.7	18.3	10.9	2.3	2.3	0.2	0.2	0.2
Grain binder	0.8	1.1	1.7	8.0	6.5	16.4	19.2	22.9	14.0	6.1	1.6	1.1	0.6	3.5	3.6	7.3	22.0	8.6	19.8	15.4	10.9	6.8	1.0	0.3	0.8	—
Grain drill	0.9	3.0	1.3	3.9	7.7	17.6	18.8	22.6	15.5	6.0	0.9	0.9	0.9	5.6	1.4	9.7	11.1	4.2	18.0	18.0	15.3	8.3	4.2	2.8	1.4	—
Grain elevator	—	—	—	—	—	—	—	—	—	—	—	—	—	5.8	3.2	3.7	8.0	6.9	14.8	16.0	20.6	14.0	5.8	0.9	0.3	—
Hay loader	9.2	4.9	4.5	15.6	9.4	21.6	14.6	12.2	5.2	1.8	0.6	0.3	0.1	6.9	12.9	7.9	24.7	14.9	12.9	7.9	9.9	1.0	1.0	—	—	—
Manure spreader	5.9	3.7	4.2	14.8	9.6	22.8	17.2	14.1	5.6	1.7	0.1	0.1	0.2	10.7	13.2	12.4	14.9	9.9	15.8	9.9	7.4	2.5	2.5	0.8	—	—
Milking machine	—	—	—	—	—	—	—	—	—	—	—	—	—	33.0	10.1	6.4	24.9	3.7	18.3	0.9	1.8	0.9	—	—	—	—
Mower	4.5	3.6	3.3	11.4	8.9	22.5	17.8	15.7	6.2	3.5	1.1	1.1	0.4	29.3	16.8	10.6	13.0	7.7	11.5	6.7	2.9	1.0	—	—	0.5	—
Plow	.6	.2	1.1	3.9	6.4	22.2	23.1	24.9	10.6	4.7	.9	1.0	0.4	11.6	7.5	12.2	37.2	10.6	10.9	6.7	3.0	0.2	0.1	—	—	—
Rake, dump	3.2	1.1	1.8	4.4	5.4	15.9	20.0	21.5	9.3	14.4	1.2	1.4	0.4	—	—	—	—	—	—	—	—	—	—	—	—	—
side delivery	10.4	5.9	3.6	15.9	10.5	20.6	15.5	10.8	3.8	2.3	0.3	0.4	—	29.4	11.8	—	—	11.8	17.6	11.8	17.6	—	—	—	—	—
sweep	5.0	—	—	7.5	7.5	12.5	12.5	35.0	15.0	5.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Roller	4.2	1.1	2.1	10.5	9.5	21.1	29.5	13.7	5.3	2.1	.9	—	—	9.5	7.0	2.5	17.7	11.4	27.8	17.1	3.8	3.2	—	—	—	—
Spike tooth harrow	2.2	1.3	1.9	7.6	5.7	23.0	22.4	23.4	7.2	3.4	0.7	1.0	0.2	5.7	2.9	4.3	15.2	7.1	19.5	19.0	14.8	6.7	3.8	0.5	—	0.5
Spring tooth harrow	2.8	4.2	5.6	12.5	15.3	34.5	13.9	5.6	4.2	—	1.4	—	—	5.9	6.4	12.8	39.3	10.6	12.8	7.4	3.2	1.1	0.5	—	—	—
Tractor, 4-wheel rubber	—	—	—	—	—	—	—	—	—	—	—	—	—	19.2	12.8	17.3	34.7	6.4	7.7	1.9	—	—	—	—	—	—
row crop, rubber	—	—	—	—	—	—	—	—	—	—	—	—	—	20.5	12.0	16.6	41.3	5.4	3.3	0.8	0.1	—	—	—	—	—
4-wheel, steel	—	—	—	—	—	—	—	—	—	—	—	—	—	0.3	1.1	2.0	14.9	9.2	36.7	27.8	6.9	1.1	—	—	—	—
row crop, steel	—	—	—	—	—	—	—	—	—	—	—	—	—	2.9	3.5	13.8	52.3	9.7	12.9	4.3	0.6	—	—	—	—	—
Trailer, factory	—	—	—	—	—	—	—	—	—	—	—	—	—	21.8	20.0	10.9	25.5	3.6	12.7	5.5	—	—	—	—	—	—
homemade	—	—	—	—	—	—	—	—	—	—	—	—	—	12.1	8.7	9.6	34.0	10.9	17.8	5.0	1.3	0.4	0.1	0.1	—	—
Truck	—	—	—	—	—	—	—	—	—	—	—	—	—	10.4	7.7	10.6	30.5	10.9	20.0	7.4	2.0	0.5	—	—	—	—
Wagon	—	—	—	—	—	—	—	—	—	—	—	—	—	2.6	1.6	2.9	5.9	4.1	14.7	17.9	24.6	12.7	6.8	2.3	2.6	1.3
Seeder	4.4	4.2	4.7	13.1	8.9	21.6	18.8	15.6	5.4	2.5	0.5	0.2	0.1	10.2	4.1	4.1	20.3	8.2	26.5	14.3	8.2	4.1	—	—	—	—

TABLE 11. UNUSED HORSE-DRAWN EQUIPMENT BY TYPE OF FARMING AREA.

Machine	Number per 100 farms					
	Northeast Dairy	Eastern Livestock	Cash Grain	Western Livestock	Southern Pasture	State
Corn planter	1.8	1.6	.9	1.6	2.8	1.8
Cultivator	4.5	7.0	2.6	8.0	8.5	6.4
Disk, single	1.6	2.0	.4	1.0	1.1	1.2
Grain binder	7.1	2.5	3.8	2.6	3.8	3.9
Plow	8.4	9.1	1.7	4.3	6.5	5.8
Spike harrow	.6	1.4	.2	.7	1.4	.9

TABLE 12. TOTAL ANNUAL SERVICE OF MACHINES BY FARM SIZE.

Machine, power, size	Unit of use	Size farm in acres			
		0–120 A.	121–280 A.	281 & over	All farms
Combine under 5'	acres	69.3	64.3	81.2	70.5
6'	"	174.5	153.7	182.4	166.3
7'	"	193.5	212.4	181.4	201.8
Cornpicker, 1-row	"	61.9	62.5	100.0	68.2
2-row	"	143.4	161.4	171.3	162.9
Corn planter, horse, 2-row	"	33.0	55.6	90.6	52.9
Corn planter, tractor, 2-row	"	54.1	72.4	129.2	85.5
Corn planter, tractor, 4-row	"	137.0	195.8	209.5	198.2
Corn sheller, 60 b.p.h. & less	bushels	1,044.4	1,634.8	575.0	1,342.7
61–100 b.p.h.	"	825.0	1,143.7	12,139.9	3,108.5
over 100 b.p.h.	"	11,600.0	7,940.0	27,301.0	10,164.5
Cultivator, horse, 1-row	acres	52.6	63.7	74.4	61.4
2-row	"	79.8	108.5	118.8	99.9
tractor, 2-row	"	118.0	186.1	277.3	190.1
4-row	"	198.0	230.6	502.5	367.8
Disk, single, horse 8' & less	"	63.5	94.4	87.9	77.9
9'–10'	"	94.0	143.0	242.9	129.2
11'–15'	"	122.3	130.4	269.0	140.4
tractor 8' & less	"	91.9	156.5	325.2	146.4
9'–10'	"	146.3	191.6	210.8	182.6
11'–15'	"	160.4	251.5	377.8	278.3
Double disk horse 8' & less	"	68.2	100.1	213.4	98.7
over 8'	"	55.9	100.5	122.0	88.7
tractor 7'	"	108.4	157.5	244.1	159.4
8'	"	96.5	219.6	236.9	203.8
9'	"	109.0	214.3	158.3	175.4
10'	"	130.4	214.5	327.0	206.9
Ensilage cutter, field	"	75.0	78.5	77.7	76.9
stationary	"	142.6	173.8	227.1	183.1
Grain, binder, horse 6'	"	20.6	26.9	40.3	24.5
7'	"	22.6	38.9	26.9	33.9
8'	"	28.1	44.2	60.5	42.4
9'–10'	"	22.4	26.5	20.0	25.2
tractor, 6'	"	33.7	55.3	44.0	45.2
7'	"	15.0	39.4	58.3	36.3
8'	"	31.4	56.4	79.5	56.5
9'–10'	"	75.8	68.8	100.4	81.1
Grain drill, horse, 7' & less	"	28.7	36.6	43.4	35.7
8'–9'	"	20.7	30.1	44.8	30.1
over 9'	"	29.4	48.4	49.6	44.2
tractor, 9' & less	"	41.0	35.4	82.8	45.2
over 9'	"	41.6	51.1	68.0	56.5
Grain elevator	bushels	3,493.0	4,785.0	8,357.0	5,070.0

TABLE 12. TOTAL ANNUAL SERVICE OF MACHINES BY FARM SIZE.—(Continued)

Machine, power, size	Unit of use	Size of farm in acres			
		0–120 A.	121–280 A.	281 & over	All farms
Grinder, hammer mill, 40 b.p.h. & less	bushels	1,123.5	768.6	1,350.0	900.1
41–80 b.p.h.	"	1,066.7	1,320.4	2,121.5	1,671.9
over 80 b.p.h.	"	2,175.0	1,706.7	3,372.7	2,225.1
plate, 40 b.p.h. & less	"	350.0	697.3	784.4	630.0
41–80 b.p.h.	"	964.5	1,134.7	2,421.0	1,317.4
over 80 b.p.h.	"	983.3	1,981.0	2,313.5	1,988.5
Hay loader, horse	acres	29.4	36.2	55.0	38.0
tractor	"	48.5	58.4	74.6	60.2
Manure spreader, horse, less than 60 bu.	loads	82.5	127.9	151.4	112.4
60–70 bu.	"	111.8	161.2	236.8	162.2
over 70 bu.	"	100.6	177.5	262.6	172.6
tractor, less than 60	"	63.0	98.3	256.7	137.0
60–70 bu.	"	95.3	171.0	267.3	172.4
over 70 bu.	"	125.0	138.1	323.6	202.3
Milking machine	cows	15.1	14.4	17.3	15.3
Mower, horse, 5' & less	acres	23.5	32.1	50.5	30.4
6'	"	29.2	40.2	64.1	41.2
7' & over	"	21.3	38.3	67.6	37.0
tractor, 6' & less	"	38.7	47.0	73.4	47.2
7' & over	"	69.3	78.6	100.7	86.2
Plow, horse, 18" & less	"	18.6	20.6	32.7	20.6
19" & over	"	26.3	36.8	55.1	34.5
tractor, 18" & less	"	32.6	59.8	101.5	57.1
19"–36"	"	46.5	66.9	116.8	70.8
over 36"	"	47.5	110.0	128.4	98.3
Rake, horse, dump	"	27.2	35.2	51.7	34.4
side delivery	"	32.2	44.7	61.8	44.7
sweep	"	26.1	35.7	45.5	35.5
tractor, side delivery	"	62.7	74.3	120.4	91.1
Roller, horse, 8' & less	"	42.2	43.5	64.8	46.8
9' & over	"	42.2	100.0	116.1	91.2
tractor, 12' & less	"	131.1	95.6	128.8	113.8
over 12'	"	96.8	146.2	229.3	163.9
Seeder, horse, 9' & less	"	13.2	29.7	43.8	30.9
10'–14'	"	23.0	38.3	37.5	32.5
15'–20'	"	40.3	42.3	82.6	48.4
21' & over	"	32.8	52.2	77.0	53.5
tractor, 21' & over	"	22.8	56.3	67.6	54.0
Spike harrow, horse, 7'–11'	"	49.1	88.9	148.9	69.0
12'–15'	"	83.8	116.6	160.9	103.0
16'–19'	"	106.2	161.2	239.1	142.0
20' & over	"	140.6	209.5	386.6	211.7
tractor, 15' & less	"	116.7	163.2	357.0	162.0
16'–19'	"	154.6	230.0	300.4	227.5
20' & over	"	157.4	230.1	371.1	249.4
Spring tooth harrow, horse 9' & less	"	41.4	37.6	72.1	49.9
over 9'	"	45.3	95.9	50.0	69.2
tractor, 7'–9'	"	52.5	84.9	106.6	84.1
10' & over	"	50.5	110.3	186.4	127.3

TABLE 13. ANNUAL USE ON FARM OF MACHINE OWNER BY FARM SIZE.*

Machine, power, size	Unit of use	Size of farm in acres			
		0–120 A.	121–280 A.	281 & over	Average of all farms
Combine, less than 5'	acres	45.3	46.3	67.7	53.2
5'	"	42.5	56.0	88.0	64.9
6'	"	42.6	94.5	83.5	84.2
Cornpicker, 1–row	"	39.9	50.5	88.6	54.4
2–row	"	66.4	86.7	130.0	99.5
Corn planter, horse, 2–row	"	27.9	52.3	86.7	49.2
tractor, 2–row	"	38.1	64.3	125.9	77.3
4–row	"	57.0	89.1	200.9	137.5
Corn sheller, 60 b.p.h. & less	bushels	1,044.4	408.8	575.0	609.7
61–100 b.p.h.	"	825.0	1,143.7	2,539.9	1,331.5
over 100 b.p.h.	"	1,000.0	2,738.0	17,014.2	5,276.5
Cultivator, horse, 1–row	acres	51.3	62.7	74.1	60.4
2–row	"	78.6	106.5	115.1	97.7
tractor 2–row	"	105.6	178.2	272.9	182.1
4–row	"	198.0	221.5	502.5	337.8
Disk (single) horse, 8' & less	"	62.7	93.9	83.0	76.9
9'–10'	"	90.2	142.9	242.9	127.4
11'–15'	"	103.2	126.6	269.0	136.0
tractor, 8' & less	"	79.1	156.5	325.2	141.4
9'–10'	"	138.3	183.6	210.8	175.4
11'–15'	"	144.7	240.5	370.4	266.5
Disk (double) horse, less than 8'	"	59.3	97.4	211.0	93.7
over 8'	"	53.9	94.6	122.0	85.0
tractor, 7' & less	"	89.7	155.7	224.1	151.3
8'	"	96.5	191.5	234.0	184.8
9'	"	109.0	200.8	158.3	170.6
10'	"	122.4	186.1	321.2	200.9
Ensilage cutter, field	"	5.0	30.2	51.9	17.0
stationary	"	11.9	15.0	20.1	15.9
Feed grinder, hammer mill	bushels				
under 40 b.p.h.	"	1,123.5	768.6	1,350.0	892.3
41 to 80 b.p.h.	"	1,066.7	1,295.4	2,061.5	1,539.9
over 80 b.p.h.	"	2,175.0	1,706.7	3,286.7	2,223.6
PLATE under 40 b.p.h.	"	350.0	697.3	784.4	630.3
41 to 80 b.p.h.	"	736.5	1,112.7	2,421.0	1,240.9
over 81 b.p.h.	"	983.3	1,650.0	2,313.5	1,783.5
Grain binder, horse, 6'	acres	17.5	25.6	37.4	22.2
7'	"	16.4	32.6	25.7	28.0
8'	"	23.1	39.1	56.9	37.5
9'–10'	"	22.4	26.5	20.0	25.2
tractor, 6'	"	26.5	31.4	26.9	28.5
7'	"	15.0	39.4	58.3	30.3
8'	"	23.0	48.1	73.6	48.5
9'–10'	"	32.7	51.5	91.1	63.3
Grain elevator	bushels	3,000.2	4,013.1	7,246.0	4,290.0
Grain drill, horse, 7' & less	acres	20.0	31.5	41.0	30.1
8'–9'	"	16.3	20.9	34.2	22.6
over 9'	"	20.5	31.8	41.3	33.0
tractor 9' & less	"	18.5	34.0	58.4	38.6
over 9'	"	25.0	37.1	56.9	43.2

*Acres once over.

TABLE 13. ANNUAL USE ON FARM OF MACHINE OWNER BY FARM SIZE.*—(Continued)

Machine, power, size	Unit of use	Size of farm in acres			
		0–120 A.	121–280 A.	281 & over	Average of all farms
Hay loader, horse	acres	24.8	30.6	52.3	32.8
tractor	"	41.6	49.8	70.2	52.8
Manure spreader horse-drawn	loads				
under 60 bu.	"	75.3	114.1	139.5	105.4
60–70 bu.	"	105.2	156.6	223.4	155.6
over 70 bu.	"	93.7	177.5	261.6	170.6
tractor-drawn under 60 bu.	"	63.0	98.3	256.7	137.0
60–70 bu.	"	92.8	159.5	267.3	166.5
over 70 bu.	"	125.0	134.0	323.6	202.2
Milking machine	cows	15.1	14.4	17.3	15.3
Mower, horse 5' & less	acres	21.8	30.9	48.5	29.1
6'	"	25.5	38.2	62.5	38.8
7' & over	"	18.6	36.3	66.8	35.3
tractor 6' & less	"	30.3	43.6	70.0	42.7
7' & over	"	51.8	64.7	94.4	75.8
Plow, horse 18" & less	"	18.2	20.3	31.8	20.3
19" & over	"	25.8	35.5	54.9	34.3
tractor 18" & less	"	32.2	58.4	99.4	55.9
19"–36"	"	39.3	63.7	116.3	67.0
36" & over	"	30.5	80.2	122.4	87.8
Rake, horse, dump	"	23.6	31.1	49.9	30.7
side delivery	"	29.0	39.6	59.2	40.4
sweep	"	26.1	35.7	45.5	35.5
side delivery	"	36.0	61.1	110.9	78.5
Roller, horse 8' & less	"	40.2	36.1	64.8	42.1
9' & over	"	33.1	77.6	102.3	71.9
tractor 12' & less	"	61.4	67.1	119.9	78.3
over 12'	"	41.8	87.0	188.8	110.5
Seeder, horse, less than 9'	"	13.2	29.7	43.8	30.9
10'–14'	"	19.4	34.7	36.9	30.8
15'–20'	"	20.3	35.4	72.5	38.1
21' & over	"	23.9	42.1	76.6	44.0
tractor 21' & over	"	22.8	43.1	67.6	47.2
Spike, harrow, horse 7'–11'	"	47.7	87.8	148.9	67.8
12'–15'	"	79.6	112.4	158.4	99.0
16'–19'	"	102.9	160.7	239.1	140.0
20' & over	"	138.1	207.1	381.4	208.9
tractor 15' & less	"	104.7	153.0	339.0	151.3
16'–19'	"	141.0	211.0	288.4	211.1
20' & over	"	137.3	218.6	362.9	237.5
Spike-tooth, harrow, horse 9' & less	"	41.4	37.6	72.1	49.9
over 9'	"	45.3	95.9	50.0	69.3
tractor 7'–9'	"	50.4	79.6	106.6	80.2
10' & over	"	47.8	104.2	186.3	123.9

*Acres once over.

TABLE 14. PERCENT ANNUAL USE ON FARMS OTHER THAN THE HOME FARM.

Machine, power, size	Size farm in acres			
	0–120 A.	121–280 A.	281 & over	Average of all farms
Combine, under 5'	34.6	28.0	16.6	24.5
6'	75.6	63.6	51.8	61.0
7'	78.0	55.1	54.6	58.3
Cornpicker, 1–row	35.5	19.2	11.4	20.2
2–row	53.7	46.3	24.1	38.9
Corn planter, horse, 2–row	15.5	5.9	4.3	7.0
tractor, 2–row	29.6	21.2	2.6	9.6
4–row	58.4	54.5	4.1	30.6
Corn sheller, 60 b.p.h. & less	.0	23.1	.0	10.8
61–100 b.p.h.	.0	.0	.0	11.8
100 b.p.h. & over	5.7	15.9	5.7	10.0
Cultivator, horse, 1–row	2.5	1.9	0.3	1.6
2–row	1.5	1.8	3.1	2.3
tractor, 2–row	9.7	4.2	1.6	4.2
4–row	.0	3.9	.0	8.2
Disk, single, horse, 8' & less	1.3	0.5	5.6	1.3
9'–10'	5.0	0.1	.0	1.4
11'–15'	15.6	2.9	.0	3.1
tractor, 8' & less	13.9	.0	.0	3.4
9'–10'	5.5	4.2	.0	3.9
11'–15'	9.8	4.4	2.0	4.2
Double disk, horse, 8' & less	13.0	2.7	1.1	5.1
over 8'	3.6	5.9	.0	4.2
tractor, 7'	17.3	1.2	.0	5.1
8'	.0	16.8	1.2	9.3
9'	.0	6.3	.0	2.7
10'	6.1	13.2	10.6	2.9
Ensilage cutter, field	93.3	61.7	33.2	59.8
stationary	83.5	86.3	88.5	86.8
Feed grinder, hammer mill, 40 b.p.h. & less	.0	6.7	.0	0.9
41–80 b.p.h.	.0	0.2	0.3	0.8
80 b.p.h. & over	.0	.0	0.3	0.1
plate, 40 b.p.h. & less	.0	0.1	.0	0.1
41–80 b.p.h.	3.0	0.3	.0	0.5
80 b.p.h. & over	.0	2.0	.0	0.1
Grain binder, horse, 6'	15.0	4.8	7.2	9.4
7'	27.4	56.2	4.5	17.4
8'	24.2	8.6	6.0	11.6
9'–10'	.0	.0	.0	.0
tractor, 6'	21.4	43.2	38.9	36.9
7'	.0	17.3	.0	6.5
8'	26.8	14.7	7.4	13.5
9'–10'	56.9	25.1	9.3	21.9
Grain drill, horse, 7' & less	30.3	13.9	5.5	15.7
8'–9'	21.3	30.6	23.7	24.9
over 9'	30.3	34.3	16.7	25.3
tractor, 9' & less	54.9	4.0	29.5	14.6
over 9'	39.9	19.2	16.3	10.7
Grain elevator	13.8	16.2	15.7	15.4

TABLE 14. PERCENT ANNUAL USE ON FARMS OTHER THAN THE HOME FARM.—Continued

Machine, power, size	Size farm in acres			
	0–120 A.	121–280 A.	281 & over	Average of all farms
Hay loader, horse	15.6	15.5	4.9	14.7
tractor	11.5	14.7	5.9	12.3
Manure spreader, horse, 50 bu. & less	8.7	4.8	7.9	6.2
60–70 bu.	5.9	2.9	5.7	4.1
70 bu. & over	6.9	.0	0.4	1.2
tractor, 50 bu. & less	.0	.0	.0	.0
60–70 bu.	2.6	6.7	.0	3.4
70 bu. & over	.0	3.2	.0	.0
Mower, horse, 5' & less	7.2	3.7	4.0	4.3
6'	17.1	5.0	2.5	5.8
7' & over	12.7	5.2	1.2	4.6
*Mower, tractor, 6' & less	21.7	7.2	4.6	9.5
7' & over	25.3	17.7	6.3	12.1
*Plow, horse, 18'' & less	2.2	1.5	2.8	1.5
19'' & over	1.9	3.6	0.4	0.6
tractor, 18'' & less	1.2	2.3	2.1	2.1
19''–36''	15.5	4.8	0.4	5.4
over 36''	35.8	27.1	4.7	10.7
Rake, horse, dump	15.4	11.6	3.5	10.8
side delivery	11.3	11.4	4.2	9.6
sweep	.0	.0	.0	.0
tractor, side delivery	42.6	17.8	7.9	13.8
Roller, horse, 8' & less	4.7	17.0	.0	10.0
9' & over	21.6	22.4	11.9	21.2
tractor, 12' & less	53.2	29.8	6.9	31.2
over 12'	56.8	40.5	17.7	32.6
Seeder, horse, 9' & less	.0	.0	.0	.0
10'–14'	15.7	9.4	1.6	5.2
15'–20'	49.6	16.3	12.2	21.3
21' & over	27.1	19.3	1.3	17.8
tractor, 21' & over	.0	24.0	.0	12.6
Spike harrow, horse, 7'–11'	2.9	1.2	.0	1.7
12'–15'	5.0	3.6	1.6	3.9
16'–19'	3.1	0.3	.0	1.4
20' & over	1.8	1.1	1.3	1.3
tractor, 15' & less	10.3	6.2	5.0	6.6
16'–19'	8.8	8.3	4.0	7.2
20' & over	12.8	5.0	2.2	4.8
Spring tooth harrow, horse, 9' & less	.0	.0	.0	.0
10' & over	.0	.0	.0	.0
tractor, 7'–9'	4.0	6.2	.0	4.6
10' & over	5.3	5.5	0.1	2.7

TABLE 15. ANNUAL SERVICE OF MACHINES BY TYPE OF FARMING AREA.
(Acres covered by machine, once over).

Machine, power, size	North-east Dairy	Eastern Live-stock	Cash Grain	Western Live-stock	South-ern Pasture
Combine 5'	171.3	191.0	174.3	148.6	138.7
6'	66.7	196.0	189.2	199.2	319.0
Cornpicker, 1-row	76.6	73.2	54.4	63.8	62.2
2-row	191.9	137.9	164.2	190.1	109.7
Corn planter, horse, 2-row	47.2	53.9	64.4	62.9	38.3
tractor, 2-row	113.0	86.8	101.5	78.3	77.7
4-row	143.3	153.5	251.5	155.7	——
Cultivator, horse, 1-row	61.8	55.2	62.6	61.0	63.2
2-row	105.3	90.1	125.1	104.5	84.4
tractor, 2-row	212.2	168.3	221.8	193.8	139.2
Disk, single, horse, 8' & less	73.2	73.7	88.6	95.6	74.8
9'-10'	148.0	120.4	151.7	128.5	116.3
tractor 9'-10'	213.4	192.4	212.5	157.2	144.0
Grain binder, horse 8'	41.8	34.6	46.3	52.0	33.6
tractor 8'	54.0	44.3	63.4	56.6	52.3
Hay loader, horse	29.7	33.2	41.7	43.0	53.3
Mower, horse 5' & less	27.7	28.5	27.1	36.3	30.4
6'	35.3	31.2	36.5	60.5	46.0
tractor 7'	37.6	72.8	85.0	88.5	106.5
Plow, horse, 18'' & less	19.6	20.0	21.0	21.3	20.9
tractor 19''-36''	67.6	67.5	79.7	75.2	59.7
Rake, horse, dump	28.9	25.6	20.5	43.6	39.4
side delivery	41.9	37.3	43.7	50.4	52.6
Seeder, horse, 21' & over	57.0	50.2	66.3	47.0	32.3
Spike tooth harrow, horse, 12'-15'	134.4	108.1	84.3	110.1	88.3
20' & over	204.2	230.0	209.0	233.1	130.5
tractor, 21' & over	247.5	253.8	246.5	245.1	262.9

TABLE 16. ANNUAL SERVICE OF MACHINES USED ON HOME FARM ONLY AND ON OTHER FARMS.
(Acres covered by machine, once over.)

Machine, power, size	Machines used on own farm only	Machines used on own farm plus others	25 most used machines
Combine, 5'	75.9	206.2	368.0*
6'	59.1	237.7	537.0*
Cornpicker 1-row	62.4	111.6	127.1
2-row	102.2	226.5	477.5
Corn planter, horse, 2-row	49.5	87.6	195.2
tractor, 2-row	77.4	152.5	202.9
Cultivator, horse 2-row	97.4	162.2	314.8
tractor 2-row	183.7	261.9	677.1
Disk, single, horse 9'-10'	77.0	167.3	337.7
tractor 9'-10'	166.2	320.1	490.0
Ensilage cutter, stationary	14.4	68.5	79.8
Grain binder, horse, 8'	37.6	51.0	191.1
tractor 8'	48.8	98.8	150.4
Grain drill horse 8'-9'	23.6	61.2	93.3
Mower, horse, 5' & less	28.9	38.3	155.6
tractor 7'	72.6	132.9	192.2
Plow, horse 18'' & less	19.9	47.9	72.2
tractor 18''-36''	67.0	102.1	276.0
Rake, horse, dump	29.8	79.1	177.3
side delivery	40.1	68.1	170.0
tractor, side delivery	73.8	124.9	139.8

*Ten most used machines.

TABLE 17. EFFECT OF INCREASED IMPLEMENT WIDTH ON LABOR REQUIREMENTS AND TIMELINESS.*

Size of machine	Man-hours required per acre	Saving in labor by adding additional row to machine	
		Hours	Percent†
1 row	1.00	——	—
2 row	0.50	0.50	50
3 row	0.33	.17	33
4 row	0.25	.08	25
5 row	0.20	.05	20

*Hypothetical data assuming a row width can cover 1 acre per hour and equal effectiveness per unit of width for each additional row added.

†Percent saved as compared to the next smaller size.

TABLE 18. PERCENTAGE OF TRACTORS WITH RUBBER TIRES.

	Type of tractor	
	Row crop	4-wheel
TYPE OF FARMING AREA		
Northeast Dairy	69.6	33.3
Eastern Livestock	70.1	26.6
Cash Grain	63.1	52.0
Western Livestock	59.0	16.5
Southern Pasture	55.0	18.1
SIZE OF FARM IN ACRES		
0–40	46.2	50.0
41–120	49.8	28.4
121–200	61.8	30.6
201–280	68.6	44.1
281–360	73.7	40.5
361 & over	74.8	27.3
Average of all farms	63.3	33.8

TABLE 19. OWNERSHIP OF MACHINES AND TERMS OF USE ON OTHER FARMS.

Machine, power	Percent owned in partnership	Percent used on other farms	No. other farms used on	Terms of use*				
				Partnership %	Custom %	Loan %	Exchange %	Hired %
Combine	22.7	73.4	4.4	20.5	46.7	1.6	9.4	23.8
Cornpicker	21.6	54.9	2.1	33.0	7.9	4.4	16.3	38.3
Corn planter, horse	3.5	9.1	1.1	24.7	7.1	64.2	2.0	2.0
tractor	7.1	16.5	1.4	45.0	15.0	35.0	5.0	—
Corn sheller	15.7	20.8	19.1	14.3	28.8	19.1	7.0	30.8
Cultivator, horse	2.1	4.3	1.1	11.4	14.1	66.5	4.5	3.5
tractor	4.6	9.8	6.9	21.1	16.8	47.8	0.8	13.5
Single disk, horse	2.0	3.1	1.0	31.5	3.3	65.2	0.0	—
tractor	3.1	6.5	1.1	33.1	15.0	39.2	0.0	12.7
Double disk, horse	2.3	14.3	1.0	9.9	0.0	90.1	0.0	—
tractor	6.3	9.0	1.1	26.6	23.2	40.0	0.0	10.2
Ensilage cutter, field	35.3	52.8	19.3	81.8	9.1	0.0	9.1	—
stationary	45.3	44.9	17.9	58.6	8.6	7.1	5.7	20.0
Feed grinder	3.6	1.7	1.4	43.5	0.0	10.9	27.2	18.4
Grain binder, horse	4.0	13.4	1.1	22.2	18.2	46.5	2.0	11.1
tractor	9.5	21.0	1.0	35.9	13.1	34.4	0.7	15.9
Grain elevator	4.7	30.1	1.0	31.7	6.1	28.8	16.7	16.7
Grain drill, horse	16.4	17.2	1.0	15.2	11.9	66.8	0.0	6.1
tractor	16.9	16.9	1.0	49.5	10.1	40.4	0.0	—
Hay loader, horse	9.2	10.3	1.0	52.9	4.2	38.6	0.0	4.3
tractor	7.8	10.6	1.6	23.5	5.9	64.7	0.0	5.9
Manure spreader, horse	3.3	4.9	1.0	38.1	—	58.1	0.0	3.8
tractor	5.9	3.8	1.0	100.0	0.0	0.0	0.0	—
Mower, horse	3.1	9.2	1.2	27.1	5.1	57.6	0.0	10.2
tractor	8.7	17.5	6.4	29.7	10.8	43.3	5.4	10.8
Plow, horse	1.2	3.3	1.2	16.0	6.5	71.0	0.0	6.5
tractor	4.0	9.5	1.0	18.3	26.6	38.6	0.0	16.5
Rake, horse	6.5	11.4	1.1	36.7	9.0	54.3	0.0	—
tractor	12.4	22.4	1.0	33.3	6.7	60.0	0.0	—
Roller, horse	15.9	16.7	1.2	18.3	0.0	81.7	0.0	0.0
tractor	20.5	24.7	1.1	60.0	0.0	35.0	0.0	5.0
Seeder, horse	4.2	15.2	1.0	20.0	2.9	74.9	0.7	1.5
tractor	2.8	8.0	2.0	0.0	0.0	100.0	0.0	0.0
Spike harrow, horse	1.8	3.3	1.0	21.0	11.2	67.8	0.0	—
tractor	3.9	5.4	1.0	37.6	14.4	44.9	0.0	6.1
Spring tooth harrow, horse	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
tractor	4.5	3.4	1.0	67.2	10.4	22.4	0.0	—
Tractor	3.3	27.5	4.0	12.8	57.5	7.3	22.4	—
Trailer	2.6	9.4	4.1	7.5	2.1	39.0	49.2	2.2
Truck	5.6	28.7	1.2	28.6	4.8	9.5	52.3	4.8
Wagon	1.2	14.1	5.1	1.6	5.1	15.9	77.4	—

*Misinterpretation of the term "hired" on the part of farmers and enumerators probably results in some machines being reported as hired when they were actually used on a custom basis.

TABLE 20. COST OF USE OF FARM MACHINES IN DOLLARS AND AS PERCENTAGE OF FIRST COST.

Machine, power, size	Av. 1941 price	Av. life	Annual depreciation charge		Annual interest charge	Annual cost of repairs		Annual cost of insurance housing on taxes		Total annual cost		Average cost per unit of service*
	$	years	%	$	$	%	$	%	$	%	$	
Combine less than 5'	595	11.1	8.2	48.64	13.38	0.6	3.36	2.0	11.90	13.0	77.28	1.10
5'	625	9.9	9.0	56.30	14.08	3.5	22.11	2.0	12.50	16.8	104.99	.63
6'	650	11.6	7.5	48.75	14.62	1.4	9.42	2.0	13.00	13.2	85.79	.43
Cornpicker 1-row	400	13.3	6.9	27.69	9.00	1.9	7.47	2.0	8.00	13.0	52.16	.76
2-row	750	10.8	8.2	61.36	16.88	1.4	10.46	2.0	15.00	13.8	103.70	.64
Corn planter, horse, 2-row	85	21.4	4.3	3.67	1.92	1.4	1.22	2.0	1.70	10.0	8.51	.16
tractor, 2-row	110	18.4	5.0	5.50	2.48	1.1	1.21	2.0	2.20	10.4	11.39	.13
tractor, 4-row	220	14.9	6.0	13.20	4.95	.9	1.90	2.0	4.40	11.1	24.45	.12
'Corn sheller under 60 b.p.h.	160	21.3	4.3	6.86	3.60	.5	.83	2.0	3.20	9.1	14.49	.01
60–70 b.p.h.	390	18.7	4.7	18.47	8.78	2.8	10.89	2.0	7.80	11.8	45.94	.01
over 70 b.p h.	810	20.5	4.5	36.45	18.22	1.6	12.58	2.0	16.20	10.3	83.45	.01
Cultivator, horse, 1-row	55	22.6	3.9	2.13	1.22	1.8	.99	2.0	1.10	9.9	5.44	.09
2-row	95	20.3	4.5	4.25	2.12	1.6	1.50	2.0	1.90	10.3	9.77	.10
tractor, 2-row	120	16.4	5.6	6.75	2.70	1.7	2.01	2.0	2.40	11.6	13.86	.07
4-row	255	19.0	4.7	12.05	5.72	1.6	4.06	2.0	5.10	10.6	26.93	.07
Disk, single, horse, 8' & less	65	23.4	4.0	2.57	1.48	0.7	.45	2.0	1.30	8.9	5.80	.07
9'–10'	75	21.9	4.1	3.05	1.68	1.2	.93	2.0	1.50	9.5	7.16	.06
11'–15'	90	22.9	3.9	3.52	2.02	1.1	.98	2.0	1.80	9.2	8.32	.06
tractor, 8' & less	70	20.4	4.5	3.15	1.58	.5	.37	2.0	1.40	9.3	6.50	.04
9'–10'	85	19.2	4.8	4.05	1.92	1.4	1.15	2.0	1.70	10.4	8.82	.05
11'–15'	125	17.9	5.0	6.28	2.88	.8	.99	2.0	2.50	10.1	12.65	.05
Double disk, horse, 8' & less	120	21.4	4.3	5.14	2.70	.6	.72	2.0	2.40	9.1	10.96	.11
over 8'	150	23.1	3.9	5.87	3.38	.3	.41	2.0	3.00	8.4	12.66	.14
tractor, 7' & less	120	17.4	5.3	6.35	2.70	1.6	1.89	2.0	2.40	11.1	13.34	.08
8'	130	18.5	5.0	6.50	2.92	.6	.72	2.0	2.60	9.8	12.74	.06
9'	150	19.1	4.7	7.11	3.38	.9	1.34	2.0	3.00	9.9	14.83	.08
10'	160	20.3	4.5	7.20	3.60	.4	.66	2.0	3.20	9.2	14.66	.07
Ensilage cutter, field	615	14.2	6.4	39.50	13.82	2.1	12.61	2.0	12.30	12.7	78.23	1.02
stationary	330	18.5	5.0	16.50	7.42	2.3	7.69	2.0	6.60	11.6	38.21	.21
Feed grinder, hammer mill,												
less 40 b.p.h.	100	16.6	5.3	5.29	2.25	8.9	8.87	2.0	2.00	18.4	18.41	.02
41–80 b.p.h.	140	16.0	5.6	7.88	3.15	9.2	12.92	2.0	2.80	19.1	26.75	.02
over 80 b.p.h.	200	14.3	6.4	12.86	4.50	10.1	20.20	2.0	4.00	20.8	41.56	.02
plate, less 40 b.p.h.	35	19.5	4.4	1.55	.78	8.0	2.81	2.0	.70	16.7	5.84	.01

Continued Next Page

TABLE 20. COST OF USE OF FARM MACHINES IN DOLLARS AND AS PERCENTAGE OF FIRST COST—(Continued)

Machine, power, size	Av. 1941 price	Av. life	Annual depreciation charge		Annual interest charge	Annual cost of repairs		Annual cost of insurance housing on taxes		Total annual cost		Average cost per unit of service*
	$	years	%	$	$	%	$	%	$	%	$	
Feed grinder, plate,												
41–80 b.p.h.	40	18.5	5.0	2.00	.90	8.3	3.31	2.0	.80	17.5	7.01	.01
over 80 b.p.h.	70	17.4	5.3	3.71	1.58	8.9	6.21	2.0	1.40	18.4	12.90	.01
Grain binder, horse 6'	210	27.0	3.3	7.00	4.72	1.5	3.05	2.0	4.20	9.0	18.97	.77
7'	215	25.3	3.6	7.72	4.82	1.8	3.87	2.0	4.30	9.6	20.71	.61
8'	220	22.6	3.9	8.61	4.95	2.0	4.41	2.0	4.40	10.2	22.37	.53
tractor 6'	265	21.7	4.1	10.86	5.98	1.3	3.36	2.0	5.30	9.6	25.50	.56
7'	275	22.9	3.9	10.74	6.18	1.3	3.58	2.0	5.50	9.5	26.00	.70
8'	355	21.3	4.3	15.19	7.98	1.3	4.56	2.0	7.10	9.8	34.83	.62
9'–10'	365	18.1	5.0	18.28	8.22	1.5	5.40	2.0	7.30	10.7	39.20	.48
Grain drill, horse, 7' & less	155	27.0	3.3	5.15	3.48	.4	.67	2.0	3.10	8.0	12.40	.35
8'–9'	200	24.2	3.8	7.50	4.50	.2	.40	2.0	4.00	8.2	16.40	.56
10' & over	255	24.0	3.7	9.54	5.72	.3	.67	2.0	5.10	8.2	21.03	.48
tractor, 9' & less	185	25.2	3.6	6.68	4.18	.2	.45	2.0	3.70	8.1	15.01	.33
over 9'	290	22.3	4.1	11.86	6.52	.2	.58	2.0	5.90	8.6	24.86	.44
Grain elevator	275	25.0	3.6	9.88	6.18	2.6	7.08	2.0	5.50	10.4	28.64	.01
Hay loader, horse	145	20.9	4.3	6.24	3.28	.6	.90	2.0	2.90	9.2	13.32	.35
tractor	165	20.3	4.5	7.45	3.72	.7	1.20	2.0	3.30	9.5	15.67	.26
Manure spreader, horse	170	20.8	4.3	7.29	3.82	.8	1.32	2.0	3.40	9.3	15.83	.10
tractor	210	19.6	4.5	9.45	4.72	.5	1.13	2.0	4.20	9.3	19.50	.11
Milking machine	90	18.2	5.0	4.50	2.02	7.0	6.31	2.0	1.80	16.3	14.63	.96
Mower, horse, 5' & less	95	21.9	4.1	3.86	2.12	2.4	2.28	2.0	1.90	10.7	10.16	.33
6'	100	21.4	4.3	4.29	2.25	2.0	1.97	2.0	2.00	10.5	10.51	.26
7' & over	105	20.0	4.5	4.75	2.38	2.3	2.41	2.0	2.10	11.1	11.64	.31
tractor, 6' & less	120	19.7	4.5	5.40	2.70	1.7	2.04	2.0	2.40	10.4	12.54	.27
7' & over	130	16.2	5.6	7.31	2.92	1.5	1.99	2.0	2.60	11.4	14.32	.17
Plow, horse 18" & less	75	25.3	3.6	2.68	1.68	1.1	.81	2.0	1.50	8.9	6.67	.32
19" & over	100	24.5	3.8	3.75	2.25	1.3	1.29	2.0	2.00	9.3	9.29	.27
tractor 18" & less	95	17.4	5.3	5.00	2.12	2.5	2.41	2.0	1.90	12.0	11.43	.20
19"–36"	115	17.6	5.0	5.72	2.58	2.3	2.68	2.0	2.30	11.5	13.28	.19
over 36"	170	19.4	4.7	8.05	3.82	2.6	4.37	2.0	3.40	11.6	19.64	.20
Rake, horse, dump	55	24.8	3.6	1.96	1.22	.6	.32	2.0	1.10	8.4	4.60	.13
side delivery	120	21.6	4.1	4.91	2.70	.5	.60	2.0	2.40	8.8	10.61	.24
sweep	60	27.3	3.3	2.00	1.35	.9	.51	2.0	1.20	8.4	5.06	.14
tractor, side delivery	130	20.9	4.3	5.57	2.92	1.4	1.81	2.0	2.60	9.9	12.90	.14

TABLE 20. COST OF USE OF FARM MACHINES IN DOLLARS AND AS PERCENTAGE OF FIRST COST—(Continued)

Machine, power, size	Av. 1941 price	Av. life	Annual depreciation charge		Annual interest charge	Annual cost of repairs		Annual cost of insurance housing on taxes		Total annual cost		Average cost per unit of service*
	$	years	%	$	$	%	$	%	$	%	$	
Roller, horse, 8' & less	60	22.7	3.9	2.35	1.35	.0	.00	2.0	1.20	8.2	4.90	.10
over 8'	120	24.1	3.8	4.50	2.70	.2	.30	2.0	2.40	8.2	9.90	.11
tractor, under 12'	75	22.1	4.1	3.05	1.68	.4	.27	2.0	1.50	8.7	6.50	.06
over 12'	125	21.5	4.1	5.14	2.82	.8	.94	2.0	2.50	9.1	11.40	.07
Spike harrow, horse 7'–11'	25	25.6	3.5	0.88	.58	.2	.05	2.0	.50	8.0	2.01	.03
12'–15'	35	25.3	3.5	1.24	.78	.6	.21	2.0	.70	8.4	2.93	.03
16'–19'	45	24.4	3.8	1.71	1.02	.6	.27	2.0	.90	8.7	3.90	.03
20' & over	55	23.8	3.7	2.04	1.22	1.2	.66	2.0	1.10	9.1	5.02	.02
tractor 15' & less	45	22.5	4.1	1.86	1.02	.3	.14	2.0	.90	8.7	3.92	.02
16'–19'	50	23.4	3.9	1.96	1.12	.8	.39	2.0	1.00	8.9	4.47	.02
20' & over	70	22.1	4.1	2.86	1.58	.8	.54	2.0	1.40	9.1	6.38	.03
Spring tooth harrow, horse, 9' & less	30	19.9	4.5	1.35	.68	.8	.25	2.0	.60	9.6	2.88	.06
over 9'	65	22.2	4.1	2.68	1.48	.2	.13	2.0	1.30	8.6	5.59	.08
tractor 7'–0'	45	20.3	4.6	2.05	1.02	1.0	.45	2.0	.90	9.8	4.42	.05
10' & over	75	19.6	4.5	3.35	1.68	.8	.63	2.0	1.50	9.5	7.16	.06
Tractor, row crop†	950	12.5	7.5	68.40	19.00	1.5	14.02	2.0	21.38	12.9	122.80	
4–wheel	825	15.0	6.0	49.57	18.58	1.8	14.61	2.0	16.50	12.0	99.26	
Trailer†–2–wheel, factory	105	12.6	7.0	7.31	2.38	.0	.00	2.0	2.10	11.2	11.79	
4–wheel, factory	175	17.9	5.0	8.72	3.92	.8	1.36	2.0	3.50	10.0	17.50	
2–wheel, homemade	16	14.7	5.8	0.93	.35	6.9	1.11	2.0	.32	16.9	2.71	
4–wheel, homemade	26	14.7	5.9	1.53	.58	8.0	2.09	2.0	.52	18.2	4.72	
Truck ½ ton†	800	10.9	8.2	65.45	18.00	1.8	14.13	2.0	16.00	14.2	113.58	
1½ ton	1225	12.8	6.9	84.85	27.58	1.8	21.95	2.0	34.50	13.8	168.88	
Wagon†	120	27.5	3.2	3.86	2.70	1.5	1.83	2.0	2.40	9.0	10.79	

*Cost per acre for field machines, cost per bushel for corn sheller, feed grinder, grain elevator, cost per cow for milking machines and cost per load for manure spreader.

†Total cost only. No data on total use.

TABLE 21. MACHINE COST BY FARM SIZE.

Machine, power, size	Total annual cost						Cost per acre*					
	Farm size, acres						Farm size, acres					
	0–40	41–120	121–200	201–280	281–360	361 & over	0–40	41–120	121–200	201–280	281–360	361 & over
Combine, 5'	†	92.72	100.02	88.11	92.37	107.53	†	.61	.70	.50	.46	.75
Corn picker, 2-row	†	98.61	108.33	101.80	105.80	103.30	†	.68	.66	.65	.62	.60
Corn planter, horse, 2-row	7.12	7.98	8.49	8.66	9.07	9.35	.47	.23	.17	.13	.10	.10
tractor, 2-row	†	10.11	10.96	11.55	11.82	12.91	†	.18	.17	.14	.12	.09
Cultivator, horse, 1-row	5.23	5.55	5.47	5.70	5.52	5.40	.18	.10	.09	.08	.08	.07
horse, 2-row	10.10	9.38	9.81	10.46	9.81	10.14	.29	.11	.10	.08	.07	.12
tractor, 2-row	15.67	13.14	13.66	13.67	14.73	13.79	.16	.11	.08	.07	.05	.05
Disk, horse, 9'–10'	6.95	6.83	7.32	7.25	9.00	7.66	.14	.07	.05	.05	.04	.02
tractor, 9'–10'	7.43	8.29	8.58	9.48	8.72	14.45	.05	.05	.04	.04	.06	.08
Grain binder, horse, 8'	16.58	21.56	22.78	22.95	24.08	21.76	1.54	.75	.55	.44	.39	.38
tractor, 8'	†	32.23	34.92	34.27	36.37	35.71	†	1.03	.69	.50	.46	.44
Mower, horse, 5'	8.06	9.96	10.25	10.90	10.38	12.68	.45	.42	.34	.30	.26	.17
tractor, 7'	†	13.32	13.84	13.93	15.74	16.28	†	.19	.22	.17	.22	.12
Plow, horse, 18"	6.40	6.64	6.68	6.87	7.02	6.46	.85	.34	.35	.26	.25	.17
tractor, 19"–36"	15.74	12.23	13.40	13.43	15.21	15.25	1.00	.26	.22	.17	.14	.12
Tractor, row crop‡	122.24	115.76	122.05	120.66	131.09	139.42	—	—	—	—	—	—

*For acres covered both on home farms and other farms.
†Number cases too few for comparison.
‡No data on annual use.